The Scientific Review,

AND

SCIENTIFIC AND LITERARY REVIEW,

A RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

REGISTERED FOR TRANSMISSION ABROAD.]

Journal of the Inventors' Institute.

[ALL RIGHTS RESERVED.

VOL. XVI.—NO. 10.] OCTOBER 6, 1881. [PRICE 6d.

SUBJECT MATTER INDEX OF APPLICATIONS FOR PATENTS.

Aug. 21st to Sept. 20th inclusive.

The following Index gives first the class, then the name of the Inventor. In this list (com.) means Invention communicated from abroad. Further information as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur Street, Charing-cross.

ACIDS.—T. Hogben, E. Luck.

ADVERTISING, Advertisements.—J. Cooper.

AERIAL Machines, Aerostation, Balloons, &c—A. L. Blackman.

AIR, Gas and Wind Engines, and Mills, Pneumatic Motive Power.—H. Williams, J. J. Butcher, J. Wetter (com.), J. M. B. Baker.

AIR, Gases, and Vapours (Pumping, Forcing, Exhausting, Compressing, &c.) — W. R. Lake (com.), A. Chapman, J. Wetter (com.), J. M. B. Baker.

ALBUMEN, Serum.—W. P. Thompson (com.).

ALKALIES (Soda, Potash, Lithia, Ammonia.)—C. D. Abel (com.), A. M. Clark (com.).

AXLES, Shafts, Bearings, Journals, Axle Boxes, &c.—W- Currie, A. Thompson, H. F. Lawrence, and J. H. Stokes.

BAGS, Portmanteaus, Sacks, Holders, Satchels, Reticules, Knapsacks, Valises, &c.—J. Archibald.

BANDS, Belts, Straps, Chains, and Ropes for Driving Machinery, Belt Shippers, &c.—J. I. Warman, A. H. Wallis.

BANDS (Miscellaneous) E. J. V. Earle.

BARROWS and Hand-trucks.—B. Green.

BATHS, Bathing Appliances.—C. D. Douglass, W. Wyman, J. Shanks, H. H. Lake (com.).

BEAMS Girders, Rafters, &c.—J. Larne.

BELLS, Gongs, Ringing Bells, &c.—J. L. Pattullo.

BELTS, Braces, Garters, Girths and Bands for Wear.—H. Willington.

BLEACHING, Decolourising, &c.—E. Hagen (com.), J. C. Steel.

BOILERS, Coppers, Kiers, &c.—T, Barrow, L. Dove, G. W. von Nawrocki (com.).

BOLTS, Pins, Studs, Wrist Pins,—G. R. Postlethwaite.

BONE, Horn, Ivory, Treating Horns and Hoofs, &c.—G. W. von Nawrocki (com.).

BOOKS, Albums, Portfolios, Book Covers, Book Cases, Book Slides or Holders, Bookbinding, &c. —W. R. Lake (com.), J. F. Bennet, G. W. Newbury.

BOOTS, Shoes, Leggings, Clogs, Cleaning Boots, Boot-jacks.—F. Cutlan W. R. Lake (com.), T. Laycock, W. Morgan Brown (com.), H. Loads, F. Afford, W. Brown (com.)

BORING, Drilling, and Rifling, Gimlets, Augers, Drills, Reamers, Boring Bits, Ratchet and other Braces.—W. R. Lake (com.), C. Neil, M. Macdermott, W. Glover.

BOTTLES, Bottle-stoppers, Capsules, Bottling and Decanting Liquids, Stopping and Opening Bottles, &c.—G. J. Hutchings, W. R. Lake (com.), D. C. Foster, A. M. Clark (com.), W. N. Wilkinson, F. W. Lister, H. Codd.

BOXES, Cases, Bins, Chests Trunks.—W. R. Lake (com.), J. S. Downing, E. J. V. Earle, R. M. Clark, S. Pitt (com.), F. Myers, J Darling.

BREAKS for Machinery, Stop Motions, &c.—A. Galland (com.)

BREAKS for Railways, Tram Cars, and Road Carriages.—J. Pilbrow, P. W. Duffy, A. Galland (com.)

BREWING, Treating Malt, and Malt Liquors.—A. W. Gillman, S. Spencer, E. Luck.

BRICKS, Tiles, and Building Blocks.—T. Le Poidevin, H. Hall, F. G. Pearson, J. Dunnachie, G. Jobson, E. de Pass (com.)

BRUSHES, Brooms, Mops.—W. R. Lake (com.), B. J. B. Mills (com.)

BUCKLES, Clasps, &c.—G. W. Newbery, G. F. Bennet.

BUILDING, Flooring and Roofing, Walls, and Ceilings, &c.—H. Hall.

BUTTONS, Studs, Sleeve Links, and other Dress Fasteners, Eyelets, Button Holes, Solitaires, &c.—G. Phillips, W. L. Wise (com.)

CANS, Canisters, Tins, Drums, &c.—M. Benson (com.), J. Storer, H. H. Lake (com.)

CARRIAGES, Cabs, Omnibuses, Waggons, Carts, Trucks, Perambulators, Barrows, Loading, Unloading, and Tipping Carts, &c.—O. C. Alty, E. A. Brydges (com.), H. Benest, G. W. von Nawrocki (com.), G. Asher, E. H. Grey, H. H. Lake (com.), G. White.

CASKS and Barrels, Cask-stands, Vent-pegs, Tilting Casks &c.—J. Storer, H. Blair.

CASTING and Moulding.—J. J. Sachs, W. R. Lake (com.), T. Le Poidevin, A. M. Clark, (com.), S. Pitt (com.), H. Codd.

CHAINS, Chain Cables, Shackles, Links, Swivels, &c.—J. J. Warman, A. H. Wallis.

CHEQUES, and other Monetary Documents, Cheque-Books, Bank Notes, Forms, Bills, Receipts, Invoices, &c.—A. A. Cochrane.

CHURNS, Making Butter, &c.—W. Rainbow, J. M. Hill.

CISTERNS, Water Tanks, Reservoirs, Vats, &c.—W. Wright.

CLEANING and Polishing.—E. W. Lay, G. Martin, E. Jesty, W. Saunders.

CLOCKS, Watches, Chronometers and other Timekeepers, Watch Keys, &c.—C. Shepherd, J. Wetter (com.), A. H. Turner, F. Worth.

COATING and Covering, &c.—A. B. Rodyk (com.)

COFFEE, Cocoa, and Tea; Coffee-pots, Teapots, Urns, &c.—J. S. Downing, J. Wetter (com.), J. P. Brougham.

COINS, &c.—E. L. Walford.

COLUMNS, Pillars, Pedestals, Posts, &c.—A, S. Murphy.

COLLODION.—S. Pitt (com.)

CONDENSING Gases, Fumes, and Vapours, Condensers, &c.—L. McIntyre.

COOKING, and Apparatus used in Cooking, &c. —J. Lacey.

COPYING, Tracing, Drawing, Writing, Ruling Paper, &c.—J. J. Sachs, J. Hope.

CUTTING, Sawing, Planing, and Carving &c.—E. Lemmon, J. Fox, J. M. Wilson, J. Taylor, F. Myers.

CYLINDERS and Rollers, Covering Cylinders and Rollers.—J. Bardsley, J. Larne.

DENTISTRY, Artificial Teeth, Tooth Powders, &c.—S. Pitt (com.)

DIES, &.—A. Storer.

DISTILLING and Rectifying.—E. Luck, R. Haldane, J. Telfer.

DOORS, Gates, and Door Furniture.—H. Benest, H. H. Lake (com.), A. Martin.

DRAFT excluders, &c.—R. W. Newlands.

DRAINS, Sewers, Gutters, Gratings, Gulleys, Ditches, Traps, Sinks, &c.—C. S. Rolfe, R. H. Reeves. J. Shanks.

DRESSES &c.—H. Willington.

DRYING or Desiccating, Expelling Moistures, &c.—W. M. Brown (com.), W. A. Gibbs, C. A. Barlow (com.), A. W. Gillman, S. Spencer.

DYES, and Printing Colours, Dyeing and Staining, &c.—J. Wolff, J. H Johnson (com.), F. Wirth (com.), F. A. Gatty, J. Wolstenholme.

EARTHENWARE and Porcelain, Ceramic Wares, Terra-cotta, &c.—J. Dunnachie.

EASELS &c.—J. Kellett.

ELECTRICITY, Galvanism, and Magnetism, and their Application.—R. E. Dunston, C. Clarke, J. Leigh, C. Shepherd, W. M. Brown (com.), A. Banks, W. R. Lake (com.), P. Jensen (com.), H. A. Harborow, A. J. Hallam, J. Walsh, J. Sellor, W. E. Irish, W. Smith, G. E. Dering, E. de Pass (com.), W. Clark (com.), H. Newton.

ELECTRIC Light.—G. Pfamkuche, S. Pitt (com.), F. H. Engel (com.), W. Crookes, A. L. Fyfe, J. Main, A. Tubini, D. G. Fitz-Gerald.

ENAMELLING.—F. G. Pearson.

EXCAVATING and Dredging, Embankments.—W. D. and S. Priestman.

EXPLOSIVE Compounds, &c.—S. Pitt (com.), W. R. Lake (com.)

FABRICS, Elastic Fabrics.—J. Barlow and J. Warburton.

FELT, &c.—M. Hilton.

FIBRES (obtaining and treating).—W. A. Barlow (com.), W. and W. Lord, M. Hilton.

FILTERS; Filtering, Purifying, and Clarifying Liquids, Distilling Water, Softening Water.—L. McIntyre, A. W. L. Reddie (com.)

FINISHING and Dressing Woven Fabrics, Yarns, and Threads, &c.—J. Walton, J. Wolff, C. A. Barlow (com.), C. Edmeston, S. Smith.

FIRE-ARMS, Guns, Ordnance, Gun Carriages, Targets, Rifle Practice.—P. Manser, F. Kaufman.

FIRE-ENGINES, &c.—W. R. Lake (com.), A. M. Clark (com.)

FIRE-ESCAPES, &c.—W. R. Lake (com.)

FIRE-PLACES, Stoves and Ranges, Fenders and Fire-Irons, Fire-Guards, &c.—T. Nash, E. Kaulbach, C. D .Abel (com.), G. Jobson, G. C. Davidson, J. Imray (com.), S. Clark, H. Defty, C, Braithwaite.

FISHING, Fishing Tackle.—R. Baldarston (com.)

FLOWER-POTS and stands &c.—P. Glazebrook, A. Booty.

FUEL (Artificial), Fire-lighters, &c.—W. P. Thompson (com.)

FURNACES and Fire-boxes, Supplying Furnaces with Fuel.—J. G. Galley, T. Barrow, J. H. Johnson (com.), J. Alexander and A. K. McCosh, C. W. Siemens, S. Pope, J. Wetter (com.), H. Defty and C. C. Braithwaite, L. Shaw and P. L. Fletcher.

FURNITURE, Bedsteads, Tables, Cabinets, Chairs, Desks, Wardrobes, Upholstery, Cabinet-work, &c.—J. S. Downing, R. Peyton, E. R. Johnson, F. W. Parker.

GAMES and Exercises, Billiards and Bagatelle Markers and Indicators for Games, Gymnastic Apparatus.—A. C. McLeod, J, Maxfield.

GAS (Making), &c.—H. Williams, E. Hagen (com.), J. Alexander and K. McCosh, A. Fleming, A. M. Clark (com.), J. H. Johnson (com.), P. M. Justice (com.)

GAS and other Burners.—C. W. Morley, W. T. Sugg, J. S. Fairfax (com.), J. G. Ellis, F. T. Bond, F. Wirth (com.)

GLASS (Making and Treating) and its Applications.—A. M. Clark (com.), H. Codd

GLOVES, Gauntlets, Mittens.—W. L. Wise (com.)

GOFFERING, &c.—C. D. Abel (com.)

GRAIN and Seeds (Treating, &c.)—S. Bruce, W. M. Brown (com.), K. H. Sander, F. R. Lainer, A. W. Gillman and S. Spencer, E. Luck.

GUM, &c,— B. J. B. Mills (com.)

HANDLES, &—G . Benton.

HARBOURS, Piers, &c.—A. B, Rodyk.

HARNESS, Saddles, Curbs, Whips, Releasing from Harness, Grooming Horses, Nosebags.—J. C. Mewburn (com.)

Heating, Warming, and Evaporating, Obtaining and Regulating Heat, &c.—W. S. Stephenson, T. Barrow E. Haskell and J. P. Bayly, E. Kaulbach, L. Dove, F. T. Bond, W. Wyman, H. Defty and C. C. Braithwaite.

Hoists, Jacks, Lifts, Winches, Cranes, Capstans, Windlasses, Raising, Lowering and Moving Heavy Bodies, Raising from Mines.—J. Craven, J. I. Warman, J. Wetter (com.), T. Archer, A. Shaw, T. H. Ward, E. Howel.

Knitting &c.—F. Caldwell, T. Coltman.

Knives &c.—E. W. Lay and S. Martin, G. Benton, W. A. Barlow (com.)

Knobs, &c.—H. H. Lake (com.)

Lace.—E. J. V. Earle.

Lamps, Lanterns, Chandeliers, Gaseliers, Lamd Furniture, Lighting and Extinguishing Lamps, Artificial Light, Producing Light, Candlesticks, Candelabra, &c.—T. H. F. Engel (com.), G. R. Godsal and J. O. C. Reed, H. Toy, M. Merichenski, J. Chatwin and S. Shipway, J. Wetter (com.), A. J. Hallam and J. Walsh, J. Whiteheand, J. G. Fairfax, J. G. Ellis, F. Wirth (com.), T. Ward, S. Clark, J. E. Lieson, J. Wilby, T. W. S. Stokes.

Lavatories, Washing Basins, &c.—E. R. Johnson.

Leather, Treating Hides and Skins, Parchment, Currying, Tanning, Cutting, and Ornamenting Leather.—G. R. Liversedge.

Life-buoys, &c.—J. Wetter (com.)

Lime and its Compounds in Calcium.—J. C. Steele.

Locks Latches, Bolts, Lock Furniture, Keys.—A. W. Winsor.

Manure; Treating Sewage.—H. E. Newton (com.)

Matches, Fuzees, Pipe and Cigar Lights, &c. A. and J. Hunter, S. Pitt (com.), W. Clark (com.), J. Darling.

Mathematical, Surveying, and Astronomical Instruments.—Lord Elcho.

Measures, Measuring, &c.—A. J. Bult.

Medicines, &c.—O. Mocke (com.), C. A. Angstrom, H. Willington.

Metal Waste.—A. Gutensohn.

Metals (Annealing, &c.).—C. D. Abel (com.)

Metals (Casting, Moulding, &c.)—J. Mosedale and E. Urry, E. Hoskins and C. Harvey.

Metals (Coating, &c.)—W. Elmore and J. J. Atkinson.

Metals (Forging, &c.)—M. Benson, W. Somers.

Metals (Smelting, &c.)—H. J. Haddan (com.), C. D. Abel (com.), T. A. Readwin, J. Steward, A. Gutensohn, J. Alexander and A. K. McCosh, G. W. Siemens, S. Pope.

Meters, &c.—W. B. Healey (com.)

Milk, &c.—A. B. Crees' H. H. Lake (com.)

Mining, Boring and Blasting Rock, Raising from Mines, Getting Coals, Draining, Lighting, and Ventilating Mines.—W. R. Lake (com.), A. and J. Hunter, J. Craven, M. Macdermott and W. Glover.

Motive-power Machines, Obtaining Motive power.—A. B. Joy, H. G. Hosmer.

Music, &c.—W. H. Squire, E. Edwards com.)

Nails, pikes, Bolts, Rivets, Screws, &c.—S. Pitt (com.)

Neckties, Scarfs, Bows, Cravats—J. E. Bevan and T. Terry.

Needles, &c.—T. Perks.

Nets, &c—R. Balderston:

Noxious Gases (Preventing) &c.—R. H. Reeves.

Oiling or Lubricating, &c.—W. J. L. Hollis, W. Currie, H. F. Lawrence and H. Stokes.

Oils, Fatty Matters, Grease.—O. Herrlich com.), R. Wheen, H. H. Lake (com.)

Optical Instruments, Optical Illusions, &c.—A. M. Clark (com.)

Ornamenting, &c.—J. J. Sachs, A. N. Hopkins and G. Halton, G. Jobson, J. H. Allen, J. Barlow and J. Warburton.

Ovens and Kilns.—J. D. Dunnachie.

Packing Pistons, &c.—J. Wetter, W. C. Stiff, J. C. Steele, E. J. V. Earle, F. Myers, H. A. Bonneville (com.)

Paints, Colours, Varnishes, &c.—C. F. Clans, A. B. Rodyke, J. Storer.

Paper Pasteboard, Papier Mache Paper Hangings.—M. Hilton.

Patterns, Designs, Models, &c.—J. J. Sachs, J. Cooper.

Pens, Penholders, Pencils, Pencil Cases, &c.—J. G. Hester, D. H. Sparling, W. R. Lake (com.)

Photography and Photographic Apparatus. Pictures, Portraits, &c.—P. M. Justice (com.), A. M. Clark (com.)

Pictures &c.—J. Cooper.

Pipes, Tubes, and Syphons: Joining Pipes.—W. D. and G. Priestman, C. S. Rolfe.

Pistons, &c.—W. Morgan-Brown (com.), F. H. F. Engel (com.),

Preserving Food, &c.—H. D. Cosswell, J. Wetter (com.), F. J. Gardener, H. A. Bonneville (com.), L. A. Groth (com.)

Presses, Compressing, &c.—W. P. Thompson, J. Mylnes and J. B. Allcott.

Printing and Transferring: Type and other Surfaces for Printing. Composing, and Distributing Type.—J. H. Young and R. Paterson, J. Wolff, A. M. Clark (com.), J. E. Muuson, J. Wolff, W. Powrie, J. Bardsley.

Propelling Machinery, Transmitting Power and Motion, Converting Movements.—A. Watkins, J. Musgrave and A. Wash, J. Kellett, A. B. Joy, J. J. Read, A. M. Clark (com.), A. Shaw.

Propelling Ships, Propellers, Paddle-wheels and Screws.—R. M. Steele.

Pulleys.—J. Lynn, J. J. Warman, T, H. Ward and E. Howl.

Pumps, Pumping and Forcing Liquids, Pumping and Raising Water and other Liquids, Pumps, Pistons, and Packing.—E. Fromentin, J. H. Fox, G. Heywood and G. Spencer, J. M. B. Barker, G. Renton.

Railways, Carriages, Coupling, Uncoupling, and Altering Positions of Carriage and Engines.—C. D. Abel (com.), C. Colwell, B. Askew, F. Deroogt.

Railway, Permanent Way, Rail Joints, Chair and Sleepers, Portable Railways, Atmospheric Railways, Switches, Points, Crossings, and Turn-tables.—T. Matthews, J. H. Johnson (com.), W. Morgan-Brown (com.), A. Berhard, F. Devooght, T. W. Bunning.

Reaping and Mowing, &c.—A. K. Stone.

Reflectors, &c.—J. Wetter (com.)

Refrigerating and Freezing, Cooling Liquids Making Ices, &c.—W. R. Lake (com.), T. Hogben, H. D. Cosswell, O. Moche (com.), E. Hesketh.

Registering, &c.—J. N. Maskelyne, W. B. Healey, A. Horne and T. Ligley, J. P. Power, J. L. Patullo, W. M. Riddell and H. Wickcus.

Roads, Paths, &c.—H. Knoblanch, G. White, B. de Pass (com.)

Rods and Bars.—J. H. Johnson (com.), J. Larne.

Ropes, Cords, &c.—T. Edmond, H. Cheesman, M. Hilton.

Salt.—T. Barrow.

Samples.—J. Cooper.

Sewing and Embroidering.—A. Watkins, J. Sefton, H. Bland, A. M. Clark (com.), W. R. Lake (com.), A. Shaw, T. Coltman, R. H. Brandon (com.)

Ships and Boats, &c.—T. C. Dunn, R. M. Steele, A. F. Yarrow, J. H. Clasper.

Ships' Boats.—S. Pettit.

Shuttles &c.—S. Tweedale, J. S. Crowley.

Sifting, Sorting, and Separating.—S. Bruce, K. Sander.

Signals &c.—A. F. StGeorge, H. E. Newton, W. R. Lake (com.)

Size, &c.—J. W. Bremmer, T. Goldie.

Smoke, &c.—J. West.

Soap.—W. R. Lake (com.)

Spades &c.—E. L. and M. A. Dietz, G. Renton, T. Trussell.

Spindles and Flyers.—T. A. Duncan, W. Currie.

Spinning, &c.—T. A. Duncan, E. de Pass (com.), J. Barbour and A. Coombe, F. Ripley and T. H. Brigg, W. R. Lake (com.), W. A. Barlow (com.), J. Chisholm and J. Clegg, B. Norton and C. Turner, B. Lancaster and E. Slater, W. and W. Lord, J. Buckley and E. Crossley, W. Currie, A. Yeates, J. Erskine, M. Hilton.

Springs.—A. Martin.

Steam and other Boilers, Cleaning and Preventing Incrustation of Boilers, Water Feeding Apparatus for Boilers.—M. Benson (com.), J. W. de V. Galway, E. Fromentin, J. R. Oldham, L. McIntire, J. Blake.

Steam Engines (Stationary, Locomotive, and Marine.)—C. D. Abel (com.), J. Warmam, J. Fox, C. Colwell, A. B. Brown, C. Bedford, G. Heywood and S. Spencer.

Steering and Guiding.—J. Lynn, F. H. F. Engel (com.), H. Muir and J. Caldwell.

Straps.—H. H. Lake (com.),

Sugar and Syrups, Glucose.—W. M. Brown (com.), P. Jensen (com.), W. Thompson, J. Mylne and J. B. Alliott.

Surgery, &c.—C. A. Angstrom, J. C. Mewburn (com.) H. Willington.

Teaching.—J. Kellett.

Telegraphs; Telegraph Printing Apparatus.—W. R. Lake (com.), C. D. Abel (com.), E. Mercadier.

Threads and Yarns.—R. M. Clark, H. Grey,

Tobacco and Snuff, Cigars, Cigar-Holders. Pipe and Cigar-lighters, Smoking Pipes, Tobacco Pouches, &c.—J. B. Davies, D. Nicoll, M. Appelbaum, W. Clark.

Torpedos.—A. F. Yarrow.

Tramways and Tramway Carriages, Tramway Locomotives.—J. H. Johnson (com.), A. Berhard, F. Devoght, T. W. Bunning.

Traps for Drains, &c.—C. S. Rolfe.

Trimmings, &c.—E. J. V. Earle, L. A. Walters and V. George.

Umbrellas, Parasols, &c.—A. M. Clark (com.)

Valves, Taps, Stop Cocks, Plugs; Regulating the Flow and Pressure of Fluids.—J. Challender.

Velocipedes.—W. G. Hammon, G. R. Godsall and J. O. C. Read, J. I. Warman, E. C. F. Otto, J. Kellett, J. K. Starley, E. A. Smithe, J. White and J. Asbury, H. Wilkinson, J. Humpage, H. Haes, R. H. Froude, G.M. F. Molesworth, H. F. Lawrence aud H. Stokes, G. Renton, E. R. Settle, J. Adams, J. E. Lieson, T. E. Heath.

Ventilation: Supplying and Purifying Air for Buildings, Mines, Ships, Carriages, &c.—H. D. Cresswell.

Washing, Cleansing, and Wringing Fabrics, Yarns, and Materials.—J. Wolstenholme, A. Shaw.

Wearing Apparel, &c.—J. Fox, J. Taylor.

Weaving, Braiding, Plaiting, Preparing for Weaving.—J. Winter ana T. Ivers, J. Northrop, E. Grube, E. R. Dutton and J. Holding, S. Tweedale, E. Smethurst, J. S. Crowley (com.), W. Mather, R. S. and E. Collinge.

Weighing, &c.—S. Bruce, J. S. Downing, J. C. Mewburn (com.)

Wheels for Carriages, &c.—J. Mosedale and E. Urry, W. Somer, A. Shaw.

Winding Thread, &c.—W. Lancaster and E. Slater, H. Greig.

Windows.—A. M. Clark (com.)

Wire, Wire Working, &c.—C. Clark and J. Leigh, W. R. Lake (com.), J. Smith.

Wood, &c.—E. L. Lemmon, A. B. Rodyk (com.), R. Haldane and J. Telfer.

Zinc, &c.—A. M. Clark (com.)

⁂ *The above List is prepared from the Patent Records by Mr. T. Morgan, Secretary of the Inventors' Patentright Association, Limited.*

Steam Ploughing Engine.—At the Royal Agricultural Society at Derby, John Fowler and Co., of Leeds, exhibited at an adjacent trial field a new arrangement of 8-horse double-drum ploughing engine. The engine is of the type suitable for use in connexion with a travelling anchor. It will be remembered that in Messrs. Fowler's former double-drum engines, the two drums were placed in the same horizontal plane, the one drum being under the barrel of the boiler, and the other at the rear of the engine behind the driving wheels. In this engine, on the other hand, the two drums are placed one over the other, the direction in which the ropes are coiled being such that in the case of the lower drum, the strain due to the pull on the rope comes for the most part directly on the teeth of the driving pinion, the centre stud on which the drum revolves being thus proportionately relieved of strain. Each of the drums is provided with coiling gear, so that the ropes are coiled correctly. The leading wheels are placed comparatively close together, so that the ropes can be led off in any direction through a very considerable angle. The driving wheels are 6 ft. 6 in. in diameter. All the cast brackets, gear, &c., of the engine are of steel, while the drums are built up of steel plates to insure strength and lightness. The arrangement of the drums of course causes the boiler to stand higher than usual, but the height is not in any way objectionable, and the whole arrangement is a decided improvement on that of the former double-drum engines.

IN THE NEW FOREST.

The sun rose in splendour, and brightly shone o'er us
When in the New Forest we wandered away;
And the lark sang so sweetly her matin above us,
A chant that still lingered till gloaming of day.

Far, in the New Coppice, thro' brake, fir, and bramble;
Where winds the bright river 'neath deep woodland shade,
Whose mystical murmurs kept time with our ramble;
A voice in the silence that Nature has made!

We heard, too, the voice of the shy cuckoo sighing;
The hum of the bees, and the twitter of birds.
While the cushats and linnets above us were flying,
And even the trees gave us mystical words.

We passed by the stately Oak all in his glory;
The King of the Forest, and noblest of trees:
Whose branches still green, and whose trunk old and hoary
Still giant like stands, and weathers the breeze!

The Pine trees gave forth their sweet fragrance around us,
Soaring high thro' their shadows of purple and blue,
And, as we looked up to the glory above us,
We felt that the sky had a magical hue.

We heard the night hawk from his old eyrie calling;
And the swallows flew out from their nests 'neath the eaves,
While we watched the swift stream thro' the water-break falling,
By willow and mallow, all tangled in leaves.

And, when in the gloaming, far homeward returning,
The owls and the bats flew low thro' the shade:
How sweet 'twas to see the sun's last ruddy burning,
To watch the stars peep, and the soft twilight fade!

HENRY GEORGE HELLON.

PATENTS IN TURKEY AND LIBERIA.

GENERAL patent laws have been lately passed and promulgated in Turkey and Liberia, in which countries American citizens may now, for the first time, secure their new inventions.

The Turkish patent law is substantially a copy of the French and German systems. Any person may take a patent on deposit of drawings and specifications. Longest term of the patent fifteen years, annual tax 18 dols. The invention must be worked within two years from the date of the patent. The penalties for infringement and the proceedings are the same as in European countries.

In Liberia the patentee must be the inventor, or must have lawfully acquired the invention from the inventor. Drawings and specifications must be furnished. The Government fee is fifty dollars. The proceedings are much the same as in taking an American patent. The invention must be worked within three years after the grant of the patent. Those desiring to obtain patents in either of the above countries may obtain further information at this office.

ON SOME OF THE DEVELOPMENTS OF MECHANICAL ENGINEERING DURING THE LAST HALF-CENTURY.

AT the British Association Sir F. J. Bramwell read a paper on the above subject, of which the following is an abstract:—

The author referred to the steam-engine employed for manufacturing purposes. In 1831 the boiler which supplied the steam appeared to have been designed rather for the convenience of the sweeps, who periodically went through the flues to remove the soot that was caused by imperfect combustion, than for withstanding any internal pressure of steam, and the consequence was that the engines in those days were only worked at from 3½lb. to 5lb. pressure; and in consequence of the low pressure and the low rate of speed very large cylinders were required in order to obtain a given amount of power. In 1831 the boilers were almost invariably cylindrical, and they owed to the late Sir William Fairbairn that the danger, which for some years prevailed, of the collapse of those cylindrical fire-places was entirely removed. Now all risk was at an end, and much greater power was obtained from the boilers of the present day than could be extracted from those of equal size constructed in 1831. In that year there were a considerable number of paddle-steamers running along the rivers of England and crossing by the Channel to the Continent, but there were no ocean steamers properly so-called, and no steamers used for warlike purposes. The boilers used for paddle-steamers were inappropriate. They were mere tanks, and would only stand a pressure of from 3½lb. to 5lb.; besides which the consumption of coal was very heavy, it being stated that it would be impossible for a steamboat to cross the Atlantic, because they would not be able to carry sufficient fuel. In the present year the steam vessels were built either of iron or steel, and he did not think it would be long before the iron would disappear and give place entirely to the metal which he thought was properly called steel, although he concurred that it was quite impossible to say where iron ended and steel begun. The engines were now supplied with steam from cylindrical boilers of enormous strength, capable of being worked at a pressure of from 80 to 100lb. per square inch. The compound engine was now commonly used for steam navigation, and the consumption of fuel had fallen considerably, so that a voyage might be made with coal taken from the home port. Their president yesterday alluded to the employment of ether as a means of utilising the heat which escaped into the condenser, and he gave some account of what was done by M. Dutrembly. It so happened that he (the author) had occasion to investigate the matter at the time. Very little was done in England, one difficulty being the Excise interference with the manufacture of ether; but in France it was applied in the case of four large vessels. He went out there and inspected them, and there was no doubt that there was obtained an ether pressure of about 15lb., and that very economical results were obtained. The scheme, however, was abandoned in consequence of the practical difficulties that arose. It need hardly be said that ether vapour was a very dangerous thing to deal with, and the man in the engine-room had to work very much like men in a fire-mine, making use of Davy lamps. In 1831 the Manchester and Liverpool railway had been carrying passengers for about a year. The engines then weighed from eight to ten tons, and a speed of about 20 miles an hour was obtained. The pressure was from 40lb. to 50lb.; the rails were jointed on the chairs, and the chairs were placed upon stone blocks. In 1881 steel rails were used, wood sleepers had replaced stone blocks (and they would speedily give way, he believed, to steel sleepers), joints were no longer made upon the chairs, but by means of fish plates; the speed obtained was from 50 to 60 miles an hour. At slow speed good engines would draw 800 tons, and engines were made which weighed 45 tons, and in connexion with which the injector was in constant use. Notwithstanding the increased speed, railway accidents were fewer than they were. The latter was, no doubt, largely due to the adoption of the block system, and an efficient interlocking system, which rendered it impossible now for a man to give an unsafe signal. Then, again, there was the switch lock for facing points, which was a great source of safety; and, further, there was the continuous brakes, competent to absorb three miles of speed in every second of time. Within the last few years the gas engine had become a really useful and economical working machine; but it was not likely that the hot-air engines would be much developed. The author also referred to the improvements that had taken place in the methods for the transmission of power, and took the opportunity of saying that he regarded the steam engine as a thing of the past. He very much doubted whether those who met 50 years hence would not speak of it as a mere curiosity, to be found in museums.

SCIENCE OF VALUE TO ALL.

M. QUATREFAGES, in an address before the French Association for the Advancement of Science, at Bordeaux, thus emphasizes the value of scientific knowledge, not only for those who make it a specialty, but for all practical and intelligent men.

All men cannot be expected to enlist under the banner of professional science. But all may and must acquire scientific notions, sufficient at least to understand the utility of the intervention of special men, and to be able to judge when that intervention becomes necessary. Science is nowadays omnipresent, and tends more and more to become the sovereign of the world. What industry is there that does not want the help of the engineers, and would remain content with the progress already accomplished? What branch of manufactures would decline the help of chemistry? What medical practitioner, worthy of that name, would consent to forsake physiology, that complex science, the offspring of chemistry, and would do without natural philosophy any more than anatomy? What intelligent agriculturist does not understand that the problems of culture and production are essentially questions belonging to zoology, botany, geology, and chemistry? And in this great city, one of the queens of universal commerce, what merchant would deny the importance of geography?

Science is as indispensable to the military man as it is to the manufacturer, the medical practioner, and the agriculturist. I am not going to undervalue the share that in war falls to inspiration and gallantry. But inspiration must be enlightened by study, and courage must be aided by weapons equal in efficiency and power to those of the enemy. No more than the agriculturist or the manufacturer can the officer master all the sciences, the help of which is necessary to his profession. He cannot be expected to solve by himself all the problems raised by his single art. It is essential that he should first ascertain these problems, and confidentially appeal to scientific men, pointing out to them the application he wants. Let us, therefore, stir up the intellect of all men. Surely, we may hope to bring to light many treasures which, for want of the opportunities which it will be our object to create, might remain buried in the darkness of ignorance.

Our task will be fulfilled only when every man exercising say influence on his neighbour, or having any amount of leisure on his hands, shall have become an enlightened friend of science; when the least among labourers shall know what principles regulate the processes and the practice of his handicraft. . . Look at the results obtained in England by our eldest sister, the British Association. It is owing to its action that part of the population of England has undergone a transformation. The sons of fox-hunting squires are no geologists, philosophers, botanists, archæologists, &c. It is a banker who presides over the Anthropological Institute, and a brewer who is at the head of the Astronomical Society. The British Association reckons its members by thousands, and all the principal towns dispute the honour of its visits. Let us, then, begin our work with confidence; let us spare no efforts, for none shall be in vain. We know now that in the physical world there is no loss of power, no loss of matter. It is so, and even to a more absolute degree, in the moral world. Will is also a power, a power that increases and multiplies by transforming the minds of men like a ferment. We have the will for good; let us resolutely apply it, and we shall develop the intellects and raise hearts of men by the diffusion of scientific knowledge.

NEW PORTABLE BATTERY.

A very compact and powerful battery patented by Mr. Marcus A. Hardy, of Newport, R.I., is described and illustrated in the *Scientific American*. It is designed for medical and experimental purposes, and is very convenient and portable. The battery comprises twenty elements, and the cells are made in one entire piece of hard rubber, which is known to be indestructible with proper use. The construction of the battery is such that all of the cells can be filled in twenty seconds from the reservoir forming the base, and the exciting fluid remains in contact with the zincs and carbons only during use. Any number of cells, from one to thirty, may be brought into use as may be required. The battery cell forms the top to a hollow base or reservoir, and from each cell a small tube projects into the hollow base nearly to the bottom. To the base at one end is attached a stopcock, to which is connected a rubber tube terminating in a mouthpiece. At the opposite end of the reservoir there is a screw-capped opening for introducing the exciting liquid. The zinc and carbon plates are attached to brass connecting pieces secured to a common support of hard rubber. The connections are arranged so that the zinc of one cell is in electrical communication with the carbon of the next, and so on throughout the series. The opposing ends of the series are connected with binding posts at the end of the battery.

The brass connectors between the elements are drilled so that plug connections may be inserted to cut out any number of cells.

This battery finds an extensive application in torpedo service, and it appears to be extremely well adapted to laboratory use.

FOREIGN PATENT LAWS.

THE ARGENTINE REPUBLIC.

All new discoveries or inventions in any branch of industry confer on their originators the exclusive right of working the same during a fixed term, and under certain conditions said inventions applying to discoveries made in the Republic as well as in foreign countries.

The right is established by title called Patent of Invention. New discoveries or inventions shall be considered such that form new products of industry, new means and the new application of known means for obtaining an industrial result or product.

Patents are granted for 5, 10, or 15 years, according to the merit of the invention and the wish of the applicant, but where foreign patents have been secured the patent expires with the original patent. The fees on a patent are 80, 200, and 350 piastres (pesos fuertes), according to term of patent. Also on reissue of foreign patent the fees (additional sundry petty stamp duties are charged beyond these duties) are proportional to the term of years; the payment of the fees to be made one-half at time of application, the other half in successive yearly payments.

All applications for letters patent must be made by petition addressed to the Commissioner of Patents, said petition to be accompanied by a description, with proper drawings and patterns (all in duplicate), and a list of the objects presented with said petition being deposited with the half fees. Applications are to refer to a single chief object with its applications, together with term of patent sought for, also short and precise title of the invention. All documents to be written in the Spanish language and drawings to metrical scale.

Should a patent be refused, an appeal within ten days can be made to the Minister of the Interior, who after investigation confirms or annuls the refusal.

Certificates of addition are granted, same being subject to the same formalities as patents, except the amount of fees.

Inventors or improvers may obtain a provisional patent for term of one year on payment of 50 piastres, said provisional patent being renewable each year. The object of provisional patent is to defer whilst they are in force all grants of patents relating to the same invention or improvement until previous notice thereof is given to the original patentees.

Owner of a provisional patent may oppose an intended patent for invention similar to his own within three months.

The assignment of patents, as also the publication of patents, are provided for.

Patent is invalid if specification or drawings are incorrect or incomplete, and will become void if not worked within two years from date of issue, or if the working has been interrupted for a similar period, except should circumstances be forthcoming proving such working beyond control of the inventor.

RECENT AMERICAN AND FOREIGN PATENTS.

Fire Escape.—Mr. William A. Thompson, of Brooklyn, N. Y., has patented an improved fire escape, which consists of a cradle formed of curved side bars connected by cross bars and provided with supporting bars or legs, the cradle being hinged to a rod attached to the window casing below the sill, and having a ladder attached to its free end and provided with means whereby the fire escape can be extended from the window when required for use, and folded down inside the window when not required for use.

Prevention of Loss in Pan Amalgamation Process.—It is well known to workers of gold and silver ores that the pan amalgamation process always results in a very considerable loss of the precious metals and of the quicksilver, the loss of the former being in a great measure due to the fact that the particles of metal are coated with some substance that repels the quicksilver or prevents its contact with the metal, and the loss of the quicksilver being principally due to the "flouring" of the latter, because of its trituration in the pans and because of the presence of certain interfering mineral substances that coat the globules of quicksilver and prevent their reunion. Messrs. William H. C. Mathews, Charles W. Ayres, and Madison D. Campbell, of Bodie, Cal., have patented a cheap and effective compound to be used for preventing this loss of both the gold and silver and the quicksilver, by brightening the particles of the precious metals and by preventing the coating of the quicksilver globules.

An *improved adjustable piston*, which is so constructed that the packing of the same can be depressed and spread proportionately as it wears off, but adjusting the piston, accordingly, so that the packing will always fit closely in the pump-cylinder, has been patented by Mr. James Preston, of New York city. A packing of any desired size is held between the opposite convex or flat conical surfaces of the plates, and in case this packing becomes worn off it can be spread by forcing the disks toward each other.

A cart axle box has been patented by Mr. William H. Taylor, of Richmond, Vo. The object of this invention is to prevent journals of car axles from heating, and thus avoid the risk of danger and injury resulting from hot boxes on railroad trains. For this purpose the inventor provides for retaining water in contact with the box on one or more sides to dissipate the heat arising from friction.

Steam Steering Apparatus.—Messrs. James F. Guild, of Dundee, County of Forfar, Scotland, and Arthur E. Knights, of New York city, have patented an improved steam steering apparatus. The objects of this invention are to move a vessel's rudder easily, quickly, and with perfect regularity, to have it completely under control and almost silent in its action, thus in a great measure overcoming objections to the usual steam steering apparatus, especially on passenger steamers; also to provide for steering vessels either by hand or power; to provide for the relief of the operative mechanism from the injurious effects of shocks by strokes of waves against the rudder, and to reduce the power usually required in apparatus of this character.

Discharging Carts, &c.—Messrs. John H. Reynolds, of Emerson, Iowa, Elisha P. Reynolds, of Rock Island, Ill., and Ben Reynolds, of La Mine, Mo., have patented an improved self-dumping trap which automatically discharges its load of earth or other material into any receptacle below its dumping platforms on the release of griping irons, by the operation of a conveniently placed hand lever. The invention consists in supporting one or more pivoted dumping platforms, in an elevated framework, said framework supporting the upper end of "ramps" or inclined approaches thereto, whereon teams drawing loaded vehicles may ascend to the platforms to deposit their load of earth or other material there on and descend therefrom.

Fence.—Mr. Samuel M. Coop, of Girard, Ill., has patented an improved portable fence with panels having braces hinged to the upper parts of their uprights by pins for holding the panels erect, and having uprights and interposed spacing blocks attached to the end upright of each panel to receive the end of an adjacent panel.

An improved sleigh bolster has been patented by Mr. Herbert L. Steele, of East Bloomfield, N.J. The object of this invention is to render a sleigh less liable to upset, and to make it run more easily with less wear on the box. The invention is especially designed for bob sleighs; and it consists of a rear bolster whose ends are held in slotted blocks that are secured upon the raves of the sleigh, whereby the bolster is brought nearer the raves than in the ordinary construction, thus rendering the sleigh less liable to upset, and is kept at a fixed distance from the front bolster, and whereby the rear bob is free to rise and fall over inequalities in the road without moving its bolster back and forth.

Safety Pocket.—Mr. Albert Bee Carson, of Papinsville, Mo., has patented an improved safety pocket which can neither be picked nor cut open without the knowledge of the wearer, and which may be put in the place of the ordinary pockets in coats, vests, pantaloons, or other articles of wearing apparel.

The invention consists in a pocket having a mouthpiece consisting of two plates of steel or other suitable material, the main or back plate having its extremities slotted and bent upon itself, and the front plate having its extremities fitted to slide in the slots of said back plate, and provided with T-shaped ends to prevent it slipping from place.

Corn Planter.—Mr. William D. Lindsley, of Sterling, Kan., has patented an improved corn planter, which consists in the construction of the plough for opening a corn furrow, which plough is so formed as to cover the corn with soil raised by the point of the plough from near the bottom of the furrow, and with the mould board so shaped as to throw the upper portion of the furrow slices containing the weeds on the sides of the furrow.

An improved horse rake has been patented by Mr. John G. Thomas, of Judson, Mo. The object of this invention is to facilitate the gathering of hay and other substances for stacking and other purposes.

An improved horse rake of the class in which the rake proper is attached to and supported by a wheeled frame, with handles for propelling it, has been patented by Mr. George H. Preston, of Ottawa, Ontario, Canada. The improvement consists in attaching the rake proper to the rear portion of the frame or handles, in rear of a transporting wheel, by means of braces that are pivoted to the frame, and chains which may be adjusted in length as required to adapt the implement for convenient use by persons of different height.

Sulky Plough.—Mr. Sam T. Ferguson, of Minneapolis, Minn., has patented a sulky plough which is an improvement upon the sulky plough for which letters patent were granted to the same inventor February 5, 1878. In that patent the plough was swung from a bail which had an elbow extension, which latter was connected by a link with the lower end of a hand lever that was operated by the driver to raise or lower the plough. The present invention consists in connecting the link to the bail by an elbow extension which has a screw connection with the link, so that the point of connection between the link and this elbow extension may be thrown closer to the centre of oscillation of the bail, or further from it, so as regulate the depth which the plough goes into the ground.

Mine Pumps.—Messrs. Samuel B. Connor, Henry Dods, and William S. Ferguson, of Virginia City, Nevada, have patented an improved automatic counterbalance to spear rods of mining pumps. The invention consists in connecting the counterbalance with the spear rod by means of air or water pipes and cylinders provided with suitable plungers, whereby said counterbalance is made to co-operate with the spear rod.

Hoisting Mechaniser. — Mr. Edward A. Beyer, of Negaunee, Mich., has patented an improved means for connecting and disconnecting a hoisting drum and its driving shaft, and also to a brake for checking its speed when in motion. The invention consists in combining with hinged bars nuts pivoted to their ends and a shaft carrying a right and left screw.

An improved heading, stave, and spoke-sawing machine has been patented by Mr. Jesse G. Wilson, of Clayton, Ind. The object of this invention is to furnish machines for sawing logs longitudinally in the direction of their centres and to any desired depth, and which shall be so constructed that the logs can be conveniently turned and raised and lowered to bring them into proper position, and to allow one tier after another to be removed from the outer parts of the logs until the logs become so small for farther sawing.

An improved steam boiler cleaner has been patented by Mr. Abraham Johnson, of Young America, Ind. The invention consists in combining a tube set in the head of boiler above the water level, a stuffing box, and a removable tube passing through the first one, said removable tube having a bent end extending nearly to the bottom of boiler, and provided with a blow-off cock.

An interlocking switch in which the switch operating lever interlock each other, so that the switch rails cannot be moved until the signal has been given and the entire train has left the switch, has been patented by Mr. James A. Bonnell, of New York city.

An improved disinfecting and automatic flush tank has been patented by James J. Powers, of Brooklyn, N.Y. The object of this invention is to facilitate collecting and disinfecting liquid sewage and removing it after disinfection. The invention consists in a tank provided with a syphon, the inner end of which is closed by a valve on a pivoted lever, to the outer end of which a float with a vertical tubular extension is attached, whereby the float will be raised as the level of the water rises, thus closing the syphon; but when the water level has reached the upper edge of the tubular extension of the float the water will flow into the float, causing it to descend, thereby opening the syphon and permitting the water to flow from the tank, the water in the float flowing off through a small flexible tube.

Milk Cooler and Butter Preparer.—Mr. William M. Turner, Albia, Iowa, has patented an improved milk cooler designed to raise cream on the milk on the cream-gathering plan, so as to allow the farmers to set their own milk to be skimmed by the manufacturers of butter. It consists in a can having an upper and lower flanged cover and three vertical tubes, one of which leads from the tray formed by the flange on the top side of the cover, and conveys the cold water to the middle tube, which is larger, and which rises in the centre of the can to nearly the top of the same, and from the top of which the water passes into another tube on the opposite side from the first, to the bottom of the can, at which point the water emerges and surrounds the whole body of the can to height of milk, and passes off through an overflow orifice in a surrounding tank, in which the can is partially submerged, by which means a positive circulation and thorough cooling effect are produced.

Cattle Car.—Mr. Jeremiah C. Jones, of Whitt., Texas, has patented an improved stock car for transporting cattle and horses on railways; the object of the invention is to provide means for allowing the animals occasional opportunities to lie down and rest and be fed and watered.

An axle lubricator has been patented by Mr. James V. Randall, of Newtown, Pa., which relates to self-lubricating axles which are provided with oil-cups at their outer ends and nuts for closing them. The object is to provide a simple and inexpensive lubricating device which shall be adapted for use in combination with the ordinary axle and axle box.

A paper-drying machine has been patented by Mr. James S. Piper, of Rockford, Ill., which relates to machines for drying the wet sheet from an ordinary cylinder, Fourdrinier or other paper machine, the special object of the invention being to give a lap or belly to the sheet during the drying operation. The sheets so formed are used in making paper barrels.

An improved switch for dynamo-electric machines has been patented by Hans J. Muller, of New York city. The object of the invention is to facilitate connecting the internal and external circuits of a dynamo-electric machine in such a manner that any one current can be used to excite the magnets and perform work in the external circuit, while the other currents perform work in the external circuits only.

Sebacic Acid.—Mr. Armand Muller Jacobs, of Moscow, Russia, has patented a process of manufacturing sebacic or fatty acids from glycerides, consisting, first, in forming sulpho-sebacic acids by treating the oils with sulphuric acid and boiling this mixture with double its quantity of water; and, secondly, in decomposing this sulpho-sebacic water into sebacic acid and oxy-oleic acid by boiling it with water.

An improved earth auger has been patented by Mr. Edward A. Smith, of Greeley, Col. This invention is an improvement on the patent granted to the same inventor August 3, 1880, and the improvement consists in providing the semi-circular bottom of the cylindrical casing with the cutting blade, and the shaft with a semicircular cut-off plate, the edge of which is guarded by a projection on the bottom of the blade.

Folding Table.—Mr. Edward J. Rawson, of Brooklyn, N.Y., has patented an improved folding table, which can be raised to form an inclined book rest, and can be placed upon a bed or sofa in such a manner that a person lying on his back can reach the articles on the table very conveniently.

A water closet and bidet bowl has been patented by Mr. John Flanagan, of Newburg, N.Y. The invention consists in making a water closet and bidet bowl with recesses in its rim to allow the hand to be introduced for bidet purposes; also, in constructing the trunk or pot with embossments upon the opposite sides of the lower and upper parts to receive inlet and outlet air pipes for ventilating the trunk.

A regulator for nursing bottles, patented by Willard C. Carpenter, of North Stratford, N. H., is designed to allow regulation of the amount of milk drawn out, according to the age and requirements of the child. It consists in a regulating plug or faucet combined with the rubber feeding tube.

A machine for washing and beating yarn has been patented by Mr. Polydore Dorgeval, of Paterson, N.J. These improvements relate to machines for washing yarn in hanks, and have for their object to facilitate the introduction and removal of the hanks and to render the washing operation perfect.

In pulverising and concentrating ore for smelting a considerable portion of the ore, which is of light specific gravity, floats as a scum on the surface of the water as it passes from the stamp mill or pulveriser to the concentrator and is thrown off as waste. It has been found that this scum is very rich in the metals which are sought to be saved, the said metals existing in the scum as sulphurets, chlorides, oxides, &c., which, by reason of their comparatively light specific gravity, do not readily sink to the bottom with the other ores, but float on the surface. Mr. Patrick H. Dunagan, of Boulder, Col., has patented an apparatus for saving and separating this scum. This apparatus is designed to be placed between the pulveriser mill and the concentrators, but it may be made to act upon the tailings or any form of pulverised ore, with valuable results.

An improved paddlewheel recently patented by Mr. James W. Danforth, of Elizabeth, N.J., is intended to prevent the paddles from lifting water as they rise therefrom.

An improved ore amalgamator has been patented by Mr. William H. Howland, of San Francisco, Cal. The invention consists in a stirrer formed by a rotary yoke carrying paddles combined with a pan fitted with dies, against which the pulp is forced by the paddles, and an inner ring that insures the circulation of the pulp.

An improved endless belt-filing machine has been patented by Mr. Deloss H. Stephens, of Riverton, Conn. This machine is intended for the purpose of smoothing articles fed to the files by a carriage actuated by a foot lever and a connecting rod. It consists in a novel arrangement of an endless band file carrier, grooved pulleys, and grooved guides.

The Scientific Review

AND

SCIENTIFIC AND LITERARY REVIEW,

A RECORD OF PROGRESS IN

ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

JOURNAL OF THE INVENTORS' INSTITUTE,

(*Established* 1865.)

Is published in the first week of every month at the

OFFICES, 21, COCKSPUR STREET, CHARING CROSS,
LONDON, S.W.

The SCIENTIFIC REVIEW will be sent post free on prepayment of the ANNUAL SUBSCRIPTION OF 6s. 6d.; or it may be had wholesale from Messrs. KENT AND CO., Paternoster Row, or through any Bookseller or Newsagent in the kingdom, price 6d. per copy. Single copy post free from the office, 6½d.

The SCIENTIFIC REVIEW, having an old-established circulation, and being well read by Manufacturers, Capitalists, and others interested in inventions and enterprises for the promotion of industry, will be found a desirable medium to many Advertisers.

All COMMUNICATIONS FOR PUBLICATION, BOOKS FOR REVIEW, and letters respecting ADVERTISEMENTS, SUBSCRIPTIONS, &c.—be forwarded to the

Editor: 21, *Cockspur Street, Charing Cross, S.W.*

And if for notice in the next issue, before the 25th instant.

THE INVENTOR'S INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE. LONDON.

ESTABLISHED 1ST MAY, 1862.

Past Presidents:

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

President, SIR ANTONIO BRADY.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. CAMPIN, Sec.

SESSION 1880—1881.

The Session of the Inventors' Institute will commence in November.

INVENTORS' DINNER.

The Annual Dinner will take place some time in November. Gentlemen who desire to attend the dinner will please apply for tickets to the Hon. Secretaries of Dinner Committee, SCIENTIFIC REVIEW Office, 21, Cockspur Street, Charing Cross, S.W.

Monthly Notices.

Claude de Jouffroy is to have a statue erected to his memory as the inventor of steam vessels about 1751. M. de Lesseps, at its last sitting, brought before the Académie des Sciences a report in favour of Jouffroy's claim. This was adopted, and the French Government have resolved to grant a subvention for erecting a statue to Franche Comte. It should be remembered that David Ramseye patented in England an engine for propelling ships by steam in 1618 and in 1630.

Prof. Cantoni is appointed director of the meteorological station to be erected at Pavia. In addition to the meteorological and magnetic observations, the influences of light, heat, and electricity on vegetable growth are to be very carefully studied.

Prof. L. Spangenberg, Professor of Engineering Science at the Technical High School of Berlin, and Director of the Technical Versuchsanstalt, died on the 6th of August.

The Phylloxera Congress, which was announced to be held at Bordeaux from August 29th to September 3rd, has been postponed until October 10th.

The Moniteur Scientifique states that the Central Society of Chemical and Commercial Industries has nominated a commission to examine the analytical processes used in determining the value of commercial products, and revise them if necessary.

Dr. R. Angus Smith addressed a letter last year to the President of the Chemical Section of the British Association urging the importance of "obtaining for chemists a better knowledge of the first attempts to learn something of the qualities at present called chemical, as differing from those usually called physical." The Chemical Section did not entertain the idea. Dr. Angus Smith revives it, by publishing in the *Chemical News* of August 26th the original letter and some further remarks on the subject.

Mr. Gerrard A. Kinahan has communicated to the Royal Dublin Society a paper on "Black Sand in the Drift North of Grey Stones, County Wicklow," which has been printed in the *Scientific Proceedings*. This "black sand" appears, according to Mr. Kinahan, to be a very complex mixture of metallic and earthy minerals, containing traces of gold.

Dr. E. J. Mills has contributed to the "Transactions" of the Royal Society of Edinburgh, "Researches on Thermometry," to which paper we desire to direct our readers, as it draws attention to several sources of error in the thermometers usually employed, and gives the best means for connecting them.

The Congress of Americanists, which is to open at Madrid on the 25th of this month, promises, according to the Spanish papers, to be a great success. It is under the patronage of the King of Spain, and the King of Portugal may be present.

Dr. Theodor Fleitmann, of Iserlohn, has described a process for plating iron with nickel and cobalt by welding. In 1880 Dr. Fleitmann exhibited some examples of his welding processes at the Exhibition of Dusseldorf. Since that time he has greatly improved them. He now welds firmly upon iron-sheet or copper any thickness of nickel and cobalt or their alloys, and the articles thus plated preserve a bright surface even in a damp atmosphere.

Swan's Incandescent Electric Lamps.—Mr. J. Watson, proprietor of the Earnoch Colliery, near Hamilton, in Lanarkshire, on the 9th of August lighted this mine with Swan's incandescent electric lamps. As the first practical application of electricity to the lighting of coal-mines this fact deserves record, especially as the experiment was in every way a success. An experiment made in the colliery appeared to show that the risk of an explosion of fire-damp was reduced to a minimum by the use of electricity as an illuminating power.

M. Macagno has been experimenting upon the influence of atmospheric electricity upon the growth of the vine. A copper wire with a platinum point was plunged into the extremity of a branch bearing fruits, whilst another wire connected the origin of the branch with the soil. An increase of vegetation was distinct, the wood of the branches contained less potash than that of other branches, whilst the grapes contained more sugar and less acid.

THE SCIENTIFIC REVIEW
AND
Scientific and Literary Review
INCORPORATING THE "JOURNAL OF THE INVENTORS' INSTITUTE."

OCTOBER, 1881.

THE PATENT LAWS AND THE BOARD OF TRADE.

(Letter to the President of the Board of Trade.)

To Right Hon. JOSEPH CHAMBERLAIN,
President of the Board of Trade, &c., &c.

SIR,—As Secretary of the Inventors' Institute, also as many years concerned in Patent business, and a co-worker for Patent Law Reform with the late Thomas Webster, Esq., Q.C., F.R.S., (partially successful by enactment of Patent Law Amendment Act, 1852,) I am in duty bound to address you on the subject above mentioned, which, curious as it may seem, is thoroughly understood by only some *few* persons, if its *legal*, *industrial*, and *commercial* phases be *bona fide* taken into account—hence it seems necessary to set forth, though briefly, wherein the present law is defective and needs amendment.

The objections to the law as it stands are :—

1. The *cost* of obtaining protection or Patent is MUCH TOO HIGH.

2. The Attorney and Solicitor-General as the prominent authorities in Patent business, are specially objected to, as neither by technical scientific training nor sufficiency of time are they enabled to fulfil all necessary requirements, they being in point of law the Examiners for Patents with *autocratic powers of allowance and rejection.* Scarcely anyone understands this, for until a few years ago these learned functionaries never took any action beyond dealing with the grant of a Patent on the ground of its illegality or impropriety as evidenced by its title, &c.; hence the obtaining of a Patent was considered very much a matter of course. Latterly, *aided* by clerks of the ordinary legal clerk type, a number of objections have been made to applications for patents, mostly verbal criticisms, the results being disagreeable discussions and delays, for it must be clearly understood that nothing like a search into novelty is attempted, and the whole thing is merely bother and confusion, and in reality a grant or rejection thereof becomes a hap-hazard matter. Independently of the above matters the Attorney or Solicitor-General is from time to time called upon to decide in cases where fraudulent applications seek to supplant the true. Here they can in some cases decide without appeal, and can enforce the payment of *very large costs* in the same *autocratic* fashion as above mentioned.

3. The Government Patent Office is as to its constitution and action much objected to. On this question it should be called to mind that its first start was under the Act of 1852, with the since widespread name of Mr. Leonard Edmunds as Clerk of the Commissioners of Patents, and it is no untruth to say the office is a chaotic institution—only the clerk above named being referred to in the Act, except the Commissioners, all *ex officio*, with plenty to do as Government functionaries, and no business-like mode of action, though they have intervened to make rules for the ease and advantage of the Government staff without regard to public convenience or repugnancy to the terms of the Act. The Publishing and Printing Department is perhaps as objectionable as any part of the present practice. Its professed object is to let the world have descriptions of inventions without unnecessary delay; but as a matter of fact, dilatoriness is the characteristic of the proceedings of the office, and on one point action has been so slow as to render up till now that branch of little or no value. I refer to the classified abstracts or abridgments of Patents, works which, if properly prepared and kept up to date, are of more utility than all the other books put together, for by the aid of these abridgments an ingenious man who is about to formulate in his mind some new improvement, can whilst sitting in his own room, at a very moderate expense, get a general idea of all patents granted in his special subject, and can strictly investigate all such as seem to have any bearing on his invention, and so be enabled to take out a Patent embracing what is right and true, discarding what is wrong. Only a few of these abridgments have been issued, and some come up to twenty years ago. However, all sorts of nonsense, such as extraordinary sizes of documents and makes of paper, have met with attention in the Patent Office Rules.

In addition to the above the Patent Law is objectionable in regard to lawsuits thereon, which are allowed to be enormously expensive, even considering that all British lawsuits are very expensive. This is a difficult matter to deal with, but if the Patent Office were so rearranged as to give efficient help in the settlement of the practical scientific part of such matters, much would be done.

Sir, all this may appear to be a long catalogue of defects in the present law. Though long, it is true; and to its main facts I could testify as a regular witness if need be; but for all that it must not be assumed that the Patent Law Amendment Act, 1852, requires to be entirely revoked. In truth, the defects of the existing Law are mostly due to the fact that in the working of the 1852 Act (in accordance with what appears to be a canon of government), people (with the exception of the late Mr. B. Woodcroft, F.R.S., an acquiescing friend merely), opposed to its enactment were called in to operate its administration, and until very recently their regime has been thoroughly sustained; hence the law as now worked is a travestie of the Act rather than otherwise.

The Act only wants improving, and this I must mention because you will probably have shortly brought under your notice a Bill got up by a certain gentleman, Sir F. Bramwell, F.R.S., which will treat the subject in a very elaborate way, and will claim the sanction of the Society of Arts, a body which, from being a member since 1846 I can speak of with knowledge, is principally composed of persons having no special interest in the subject—indeed, until very recently, the Society held aloof from the Patent Law movement altogether. Such Bill would require some years to effect its full expression, and may then be found too fine spun for practical use. What Inventors want and what the public zeal requires to facilitate the production of Inventions are simply :—

1. A cheap Patent, the provisional protection to be almost nominal in cost.

2. The Attorney or Solicitor-General to be dispensed with except as occasional adjudicators.

3. Paid Commissioners to be appointed so as to secure efficient working of the Law.

4. Patent Law suits should be rendered more simple and certain in result.

5. To improve the system of lawsuits the County Courts should be rendered to the full extent available to Patentees.

Before concluding this letter it is due to you, Sir, to remark that the Bill brought before the House of Commons last Session by Messrs. G. Anderson, Alex. Brown, Hinde Palmer, and Broadhurst, will be found to meet the various points above mentioned, and further, that the sum of ten shillings set forth in the schedule of the Act as the first stamp is the same as the first fee under the Utility Designs Act, and also that if the first charges be not *very low* Patent Law amendment will be of little use to the REAL inventors, who are very poor men.

I have the honour to be, &c.,
F. W. CAMPIN.

THE BRITISH ASSOCIATION.

The practical work of the Association began August 31 with the usual preliminary meeting of the general committee, which was held in the Museum. At this meeting the retiring president, Mr. A. C. Ramsay, presided. The report of the council, which was read, proposed the appointment of Professor Bonney, M.A., as secretary, and the election to the council of Mr. Warren De La Rue, Mr. A. Vernon Harcourt, Mr. G. W. Hastings, M.P., Mr. J. C. Hawkshaw, and Professor Prestwich, in the room of Mr. Easton, Mr. Newmarch, Professor Roscoe, and Mr. Warington Smyth, who retire by rotation. These proposals were agreed to. Professor A. W. Williamson presented a statement of accounts, from which it appeared that, including £500 brought over from the Swansea meeting, there had been received £2,095, and that after all necessary disbursements had been made, including grants for research amounting to £476, there remained a sum of £88 in hand. The presidents and vice-presidents of sections were then appointed as follows:—

Mathematical and Physical Science.—President, Professor Sir W. Thomson; vice-presidents, Professor J. B. Adams, and Mr. T. Archer.

Chemical Science.—President, Professor A. W. Williamson; vice-presidents, Mr. F. A. Abel and Professor Thorpe.

Geology.—President, Mr. Ramsay; vice-presidents, Professor Prestwich and Professor W. C. Williamson.

Biology.—President, Dr. Owen; vice-presidents, Professor W. H. Flower, and Professor J. S. Burdon Sanderson.

Department of Zoology and Botany.—Dr. Owen.

Department of Anthropology.—Professor W. H. Flower.

Department of Anatomy and Physiology.—Professor J. S. Burdon Sanderson

Zoography.—President, Sir J. D. Hooker; vice-presidents, Mr. Francis Galton and Mr. C. Wyville Thomson.

Economic Science and Statistics.—President, Mr. Grant-Duff, M.P.; vice-presidents, Sir G. Campbell, M.P., and Mr. Heywood.

Mechanical Science.—President, W. G. Armstrong; vice-presidents, Mr. W. H. Barlow and Mr. C. W. Siemens.

A vote of thanks to the chairman concluded the proceedings.

In the evening a brilliant assembly, graced with the presence of many ladies, was held in the large hall of the Exhibition buildings, at which Dr. A. C. Ramsay resigned the presidency, and formally inducted his successor, Sir John Lubbock, into office. The new president was supported, among others, by Sir W. Thomson, Professor Huxley, Professor Owen, Sir J. Hooker, Professor Roscoe, Mr. Herbert Spencer, Professor Flower, and Dr. Allman. To some extent the picturesqueness of the gathering was marred by an unfortunate attempt to light the hall with the electric light. The system employed was the "Brush," but from what appeared to be a deficiency of motive power, the light was painfully unsteady and uncertain.

The substance of Sir J. Lubbock's speech is given in our last issue.

SEPTEMBER 2.

MATHEMATICAL AND PHYSICAL SCIENCE.

This section was divided into two departments, Pure Mathematics being discussed in one, and Physical Science in the other.

Sir W. Thomson, who presided in the Physical section, read a paper on some uses of Faure's accumulator in connection with lighting by electricity. He said:—

The largest use of Faure's accumulator in electric lighting was to allow steam or other motive power and dynamo to work economically all day, or throughout the 24 hours where the circumstances were such as to render this economical, and storing up energy to be drawn upon when the light was required. There was also a very valuable use of the accumulator in its application as an adjunct to the dynamo, regulating the light-giving current and storing up an irregular surplus in such a manner that stoppage of the engine would not stop the light, but only reduce it slightly, and that there would always be a good residue of two or three hours' supply of full lighting power, or a supply of eight or ten hours of light for a diminished number of lamps. He showed an automatic instrument which he had designed and constructed to speak and make the circuits between the Faure battery and the dynamo, so as automatically to fulfil the condition described in the paper. This instrument also guarded the coils of the dynamo from damage, and the accumulator battery from loss by the current flowing back, if at any moment the electro-motive force of the dynamo flagged so much as to be overpowered by the battery.

Mr. SIEMENS said that if Sir William Thomson's suggestion of using the Faure battery as a storehouse of power, to be resorted to at any moment automatically, could be carried into effect, no doubt a very valuable method would have been given to practical electricians in carrying out the application of electricity either to lighting or to the transmission of power.

Mr. SWAN, of Newcastle, said he had listened to Sir William Thomson's description of the Faure battery connected with the dynamo-electric machine with great interest, because it seemed to him to meet a great deficiency that had existed up till the present time. Under existing arrangements the accidental throwing off of a belt extinguished the lights when the dynamo-electric machine was exclusively depended upon for producing the current. It seemed that the addition of Faure's battery to this method of supply (especially when used as Sir W. Thomson proposed to use it)—namely, as a store and a regulator (with the addition of his automatic circuit opener), was the very thing wanted to make electric lighting all that was needed. He had recently had experience as to the use of the Faure battery in connection with his own lamps, and he found it to work admirably. He could not express the delight he felt in the prospect that lay before them of using the battery in connection with their other means of producing electric currents.

Sir W. Thomson also made communications to the section "On the Economy of Metal in Conductors of Electric Currents," and "On the Proper Proportions of Resistance in the Working Coils, the Electro-magnets, and the External Currents of Dynamos," while Professor Osborne Reynolds read a paper "On Surface Tension and Capillarity" and Lord Rayleigh two papers on "Some Colour Experiments" and "The Theory of Lighting."

Mr. W. H. Preece read a paper "On the Application of Electricity to the Localisation of a Bullet in a Wound." The object of the author was to show how an electric current can be made an invisible and immaterial probe, localising the position of a bullet without touching the human body or inflicting the sensation of pain.

Mr. PREECE remarked that electricity had already been used for probing purposes, but only to detect by the ring of a bell the fact that a metallic mass had been probed by the point of the instrument. The operation was performed with all its pain to the wounded sufferer, and electricity was employed only as an agent more sensitive than the touch. The conception of using electricity alone as the tool itself for this purpose occurred to Professor Graham Bell, in Washington. Professor Bell telegraphed to Mr. Preece, requesting him to consult with Professor Hughes as to the use of the induction balance for the purpose. Professor Hughes threw his whole heart into the matter. Full directions were sent out to Professor Bell, who was independently experimenting on the subject with Mr. Tainter. Experiments were made by him upon President Garfield, and there was every reason to believe that the position of the bullet had been unmistakably localised. Mr. Preece gave a brief description of the principle of Professor Hughes's induction balance, by which impurities had been detected in various metals in a way shown by Professor Chandler Roberts at the Association soirée, held on the previous evening, and which had been utilised in the Mint for the detection of bad coinage. In order to apply the instrument to the localization of the bullet in a wound, Professor Hughes recommended that the exploring coils should be made movable and portable, so that they might be placed over the body of the wounded man. He anticipated that, if the coils were brought within two inches of the bullet, its presence would be detected. The bullet could readily be brought in the line of the axis of the coils by observing the position of maximum sound. It remained when that was done to ascertain its depth. This could be effected by moving a similar bullet until neutrality was obtained, then the depth of the trial bullet would be that of the buried one. Zinc might also be employed to obtain neutrality, which would give the depth by calculation. The apparatus admitted of much variation in form, and Mr. Preece had no doubt that Professor Hughes would shortly devise a practical form which could be placed in the hands of any surgeon. Professor Bell and Mr. Sumner Tainter had worked assiduously at the matter, and had modified the instrument, and considerably increased its sensitiveness. They had extended its ranged to five inches. Professor Bell's report, as follows, to the surgeon in attendance on President Garfield, was interesting:—"I beg to submit for your information a brief statement of the results obtained here with the new form of induction balance in the experiments made this morning for the purpose of locating the bullet in the person of the President. The instrument was tested for sensitiveness several times during the course of the experiments, and it was found to respond well to the presentation of a flattened bullet at a distance of about four inches from the coils. When the exploring coils were passed over that part of the abdomen where a sonorous spot was observed in the experiments made on July 26, a feeble tone was perceived, but the effect was audible a considerable distance around this spot. The sounds were too feeble to be entirely satisfactory, as I had reason to expect, from the extreme sensitiveness of the instrument, a much more marked effect. In order to ascertain whether similar sounds might not be obtained in other localities I explored the whole right side and back below the point of entrance of the bullet, but no part gave indications of metal, except an area of about two inches in diameter containing within it the spot previously found to be sonorous. The experiments were repeated by Mr. Tainter, who obtained exactly corresponding results. We are, therefore, justified in concluding that the ball is located within the above-named area. In our preliminary experiments we found that a bullet like the one in question in its normal shape produced no audible effects beyond a distance of $2\frac{1}{2}$in., while the same bullet flattened and presented with its face parallel to the plane of the coils gave indications up to a distance of nearly five inches. The same flattened bullet held with its face perpendicular to the plane of the coils produced no sound beyond a distance of nine inches. These facts show that, in ignorance of the actual shape and mode of presentation of the bullet to the exploring instrument, the depth at which the bullet lies beneath the surface cannot be determined from our experiments." Mr. Preece concluded by saying that this showed that much remained to be done to render the instrument practical and useful, but nevertheless there was clear evidence of a new application of electricity which would be beneficial and valuable.

Professor H. A. Rowland, of Baltimore, afterwards made some remarks in explanation of Professor Bell's instrument.

Geology.

This section met under the presidency of Dr. A. C. Ramsay.

Mr. Baldwin Latham read a paper on the influence of barometric pressure on springs, in which he showed by observations he had made in the Burne Valley that atmospheric pressure exercised a marked influence upon the escape of water from springs. With a rapid fall in the barometer there was a corresponding increase in the volume of water flowing, and with a rise in the barometer there was a diminution in the flow. The experiments had been taken at a period when there was little or no rain. The paper led to an animated discussion, in the course of which several of the geologists present expressed their sense of the importance of the investigations. In his reply, Mr. Latham said he had been led to begin the observations from noticing that at Croydon every ten years there was a marked lowering of water in the wells, and that at these periods there was a prevalence of typhoid fever.

Several papers descriptive of the geology of Yorkshire and Durham were next read, among others one by Mr. J. E. Clark, on sections at York; another by Mr. G. W. Lamplough, on the Bridlington and Dimlington glacial mill beds; a third by Mr. J. R. Mortimer, on the drift at Driffield; and a fourth by Mr. A. G. Cameron, on subsidences over the Permian limestone between Hartlepool and Ripon. Mr. Clark's paper was illustrated by views shown by the limelight.

Professor H. G. Seeley read a paper in which he gave a detailed description of the skeleton of simosaurus recently discovered in the trias, near Stuttgart, and briefly noticed and figured by Dr. Oscar Fraser, attention being directed to the differences from plesiosaurus, especially in the form of the pectoral arch, and in the characters of the fore and hind limbs. The coracoid is remarkably short, and approximates to the crocodilian form, but by increasing in antero-posterior extent would become typically plesiosaurian. The scapula is distinctive, but essentially plesiosaurian in having the supra humeral process well developed. The interclavicle connected the scupula and was carried far in advance of the coracoids. The humerus is like that of a typical plesiosaur. Both ulna and radius are remarkably long when compared with plesiosaurus. The bones are said to have the same general form, and only to differ in relative length. The phlanges are in number those of a land animal, and the terminal phlanges are blunt, conical bones. The hind limb is more remarkable, having no resemblance to the plesiosaurian type. The femur is broad proximally, and tapers distantly with a slight curve. The other elements of the hind limb resemble those of the fore limb, except that the terminal phlanges are well hooked claws. Hence we see in simosauraus a land animal in process of adaptation to natatory conditions. The width of the humerus appears to have relation to a lateral flexure of the fore limb, by which the bone becomes the chief agent in movement on land. As the progression was not entirely lost, the fore arm had not become reduced in length to plesiosaurian form. The small number of phlanges was similarly explained and the hind limb discussed to show how it might assume like characters with the fore limb, Professor Seeley concluded that the plesiosaurs were original land animals, and that their ancestors and affinities must be sought in simosaurus and allied types of amphibious triassic reptiles.

Dr. Wright said that among all the animals in the old creation there were none that showed more admirably the marvellous designs of the Creator than the creatures now represented as one type—viz., the simosaurus and plesiosaurus, and he wished that had been pointed out by Professor Seeley.

Professor Marsh, U.S., said that Professor Seeley would render service to the palæontologists and anatomists of the world if he were able to tell them what those creatures really were.

Professor Seeley, in reply, said Dr. Wright had expressed himself strongly on the question of design in anatomy, and although he found that Dr. Wright's remarks were received with obvious approval, and although he knew very many who found their anatomy clearer by looking at it from the point of view of design, he (Professor Seeley) was sorry to say he was unable to see it from that point of view. He believed there would be an end altogether of philosophical anatomy—a stagnation of research that would be most deplorable in its effects—if those who were growing up were to be imbued with those views of design which were published in days gone by. The whole progress of evolution had grown out of the discarding of the old idea of design. Their modern view was the absolute antithesis of this, because they no longer considered what was best for the animal, but they endeavoured to discover what were the conditions forced on the animal, so as to compel it to develop. It was thus they had been able to raise anatomy from a mere mass of facts into a philosophy—an intelligent instrument of research upon which other researches would arise.

Professor Seeley also made a note of the archæopterus, another New World creature, about which some differences of opinion has existed as to whether it were bird or lizard. From an examination of the only two specimens in existence, one of which is in Berlin and the other in London, Professor Seeley declared it to be a true bird.

Anthropology.

The chair in this section was occupied by Professor W. H. Flower.

Mr. J. Harris Stone, London, read a paper on the Viking ship discovered at Sandefjord, Norway, in 1880.

Mr. J. R. Mortimer described six ancient dwellings found under and near to British barrows on the Yorkshire wolds.

Mr. Francis Galton, F.R.S., briefly explained the applicability of his now well-known composite portraiture to anthropological purposes. He had himself not only photographed living faces, and then by superimposing one photograph on another obtained a type face, but he had applied the same process to skulls.

Other papers were read by General Pitt Rivers on the discovery of flint implements in stratified gravel in the valley of the Nile, near Thebes, and by Mr. W. G. Knowle, "On the Origin and Use of Oval Tool Stones."

Anatomy and Physiology.

The opening address in this section was delivered to-day by Professor J. Burdon-Sanderson to a crowded audience, on the discoveries of the last half-century relating to animal motion:—

He said that the main problems of physiology related to muscular action, or, as he had called it, animal motion. He divided these problems into two—(1) In what does muscular action consist? (2) How are the motions of our bodies co-ordinated or regulated? In regard to the first he said that about the middle of this century the greatest advance since the discovery of the circulation of the blood took place—it was the epoch of the death of "vitalism." Before that time the method was to study the processes of life in relation to each other only. Since then it has become fundamental not to regard any vital process as understood at all, unless it can be brought into relation with physical standards. The advance was due primarily to J. R. Mayer; secondly, to the great physiologists still living—Helmholtz, Ludwig, Du Bois Reymond, and Brücke. Professor Sanderson dwelt particularly upon Mayer's work. Passing to the second problem he showed the grasp of the subject evinced by Descartes early in the 17th century, and drew attention to Dr. Marshall Hall's experiments on the reflex function of the spinal cord, published 49 years ago. Professor Sanderson went on to illustrate the nature of the reflex action in a larger sense than that in which it was used by Dr. Hall, or as he should prefer to call it, the automatic action of centres, by a single example—that of the nervous mechanism by which the circulation is regulated. He spoke of the discoveries of Henle, Brown-Séquard, Augustus Waller, Bernard, and Schiff. After discussing these discoveries shortly, Professor Sanderson said:—Perhaps the question has already presented itself to your minds—What does all this come to? Admitting that we are able to prove (1) that in the animal body product is always proportional to process, and (2), as I have endeavoured to show you in the second part of my discourse, that Descarte's dream of animal automatism has been realised, what have we learnt thereby? Is it true that the work of the last generation is worth more than that of the preceding ones? If I only desired to convince you that during the last half-century there has been a greater accession of knowledge about the function of the living organism than during the previous one, I might arrange here in a small heap at one end of the table the physiological works of the Hunters, Spallanzani, Fontana, Thomas Young, Benjamin Brodie, Charles Bell, and others, and then proceed to cover the rest of it with the records of original research on physiological subjects since 1831. I should find that, even if I included only genuine work, I should have to heap my table up to the ceiling. But I apprehend this would not give us a true answer to our question. Although, etymologically, science and knowledge mean the same thing, their real meaning is different. By science we mean, first of all, that knowledge which enables us to sort the things known according to their true relations. On this ground we call Haller the father of physiology, because, regardless of existing theories, he brought together into a system all that was then known by observation or experiment as to the processes of the living body. But in the "Elementa Physiologæ" we have rather that out of which science springs than science itself. Science can hardly be said to begin until we have by experiment acquired such a knowledge of the relation between events and their antecedents, between processes and their products, that, in our own sphere we are able to forecast the operations of nature even when they lie beyond the reach of direct observation. I will accordingly claim for physiology a place in the sisterhood of the sciences, not because so large a number of new facts have been brought to light, but because she has in her measure acquired that gift of prevision which has been long enjoyed by the higher branches of natural philosophy. But although we work in the certainty that every experimental result will come out in accordance with great principles (such as the principle that every plant or animal is, both as regards form and function, the outcome of its past and present conditions, and that in every vital process the same relations obtain between expenditure and product as hold outside of the organism), these principles do little more for us than indicate the direction in which we are to proceed. The history of science teaches us that a general principle is like a ripe seed, which may remain useless and inactive for an indefinite period, until the conditions favourable to its germination come into existence. The investigators who are now working with such earnestness in all parts of the world for the advance of physiology have before them a definite and well-understood purpose, that purpose being to acquire an exact knowledge of the chemical and physical processes of animal life, and of the self-acting machinery by which they are regulated for the general good of the organism. The more singly and straightforwardly we direct our efforts to these ends the sooner we shall attain to the still higher purpose—the effectual application of our knowledge for the increase of human happiness. The science of physiology has afforded her aid to the art of medicine in furnishing her vast store of knowledge obtained by the experimental investigation of the action of remedies and of the causes of disease. These investigations are now being carried on in all parts of the world with great diligence, so that we may confidently anticipate that during the next generation the progress of pathology will be as rapid as that of physiology has been in the past, and that as time goes on the practice of medicine will gradually come more and more under the influence of scientific knowledge. That this change is already in progress we have abundant evidence. We need make no effort to hasten the process, for we may be quite sure that, as soon as science is competent to dictate, art will be ready to obey.

Professor Allen Thomson, in moving a vote of thanks to Professor Burdon Sanderson for his address, said the paper showed in a striking degree how far-reaching were the principles of physiology, how difficult the labour of investigation, and how important the results to be attained.

Dr. Acland remarked that the address furnished also a strong proof of the folly of placing a legislative check upon the progress of research in that vast subject.

The vote of thanks was most cordially awarded by the section.

Dr. Montagu Lubbock read a paper on the development of the colour sense.

The author commenced by observing that Mr. Gladstone called attention to the paucity of references to colour in the Homeric poems, while Geiger and others had pointed out that this absence of any mention of colours, especially of blue, characterised a great part of ancient literature. The inference drawn was that even so lately as the time of Homer mankind were very deficient in the sense of colour. Dr. Lubbock, after explaining the various theories as to the perception of colour, argued, however, that the colours on ancient Egyptian and Assyrian monuments proved that long before the time of Homer those nations were perfectly capable of distinguishing colours. Recent experiments had moreover shown that among the lower races of savages a well-developed colour perception co-existed with a very deficient vocabulary of colour names. He concluded therefore, that there was no evidence that the colour sense had been recently developed in man. As regarded the lower animals, the question was one of much difficulty. No doubt the eye was originally very inferior as an optical instrument. At the same time he considered that the power of perceiving colour was probably developed simultaneously with that of distinguishing form. This at least might be assumed as part of the general doctrine of evolution, but it must be confessed that there was no actual experimental verification of the act.

Sir J. Lubbock agreed in the main with the views expressed by his brother, although it was a curious fact that the earliest writings should be so deficient in references to colour, and especially to certain colours; still, the earliest monuments they possessed clearly showed that at a period at least as early as those writings the perception of colour was really very fully developed, so that if paucity of reference to colour in Homeric and other writings indicated any deficiency in colour sense, that deficiency did not affect the whole human race, but only particular nations whose literature had come down to us. There was no question whatever but that the eye of a monkey was very like the eye of a human being. Monkeys were attracted to fruit by its colour, and in other ways they displayed a highly developed colour sense. As to the development of the colour sense, that was so obvious that, while there was no evidence of man ever having been deficient in colour sense, many lower animals possessed only rudimentary organs of vision—organs which enabled them only to distinguish light from darkness. No doubt, therefore, there had been a gradual development in the power of perceiving both colour and form.

Professor Sylvanus Thompson (Bristol) read a paper on a function of the two ears in the perception of space:—

The author remarked that the conception formed in our minds of the extension of space might be resolved into two parts—first, the conception of distance independent of direction; and secondly, the conception of direction independent of distance. These conceptions were based upon the perceptions of three separate senses—muscular, optical, and auditory. Those of the first two classes were fairly well known, the problems of the optical perception of space having been worked out by Wheatstone, Helmholtz, and others. The perceptions of space dependent on the ear had been but imperfectly investigated. Theories had been put forward and observations made by Anton, Steinhauser, Graham Bell, E. Mach, Lord Rayleigh, Luca, Kupper, A. M. Mayer, and by himself. The author reviewed various theories and observations which had been made. Steinhauser and Graham Bell assumed the perception of direction to depend upon the relative intensity with which a sound reached the two ears. Mach and Lord Rayleigh regarded the perception as depending rather upon the relative differences of quality in the two ears, these differences being due to the partial resolution of compound tones, according to Mach, by reason of the ear cavities acting as resonators, but according to Lord Rayleigh by reason of diffraction of the sound waves around the head. The author had in a paper on "Binaural Audition," read to this section in 1878, showed that differences of phase were also of influence in the acoustic perception of direction. The author also referred to a paper read by him before the Association in 1879 on the pseudophone, an instrument for investigating the laws of binural audition by the illusions it produces in the acoustic perception of space. After discussing the merits of the various theories to account for the facts of observation upon tones of different degrees of intensity, pitch, phase, and quality, the author propounded the following theory:—"Judgments as to the direction of sounds are based in general upon the sensations of different intensity in the two ears, but the perceived difference of intensity upon which a judgment is based is not usually the difference in intensity of the lowest or fundamental tone of the compound sound (or "clang"), but upon the difference in intensity of the individual tone or tones of the clang for which the intensity difference has the greatest effective result on the quality of the sound." The author concluded with some remarks and suggestions as to the influence on the perception of sounds of the form of the convolutions of the pinnæ of the ears, and with the suggestion that now that the physical bases of the problem had been laid down, the problems of the acoustic perception of space would be greatly elucidated by experiments upon persons possessed of abnormal hearing and upon the blind, in whom this perception is abnormally developed.

Dr. M. Foster remarked that the human voice presented complex tones, and that consequently we distinguished the direction in which it reached us with comparative ease. He suggested that the muscular sense might also have something to do with our perception of sound in the same way as it affected our vision.

Professor Bain observed that at least some valuable negative results had been obtained in the study of acoustics.

Professor J. C. Ewart (Aberdeen) read a contribution on the question of the influence of bacilli on the production of disease:—

About the end of March a new form of fever made its appearance in Aberdeen. The fever began with the usual symptoms—there was a well-marked rigor, then a sensation of coldness for some hours, accompanied with great depression, the pulse was rapid, and the temperature steadily increased to 103, in some cases to 105 degrees Fahrenheit. In the worst cases there was delirium. One of the most characteristic symptoms was an affection of the deep cervical glands and lymphatics near the angle of the jaw; the glands enlarged, and there was a feeling of fulness about the throat, congestion of the tonsils, and pain along the course of the lymphatics of the affected side. In from 24 to 48 hours the fever subsided, leaving the patient in a very exhausted state. In most cases there was a relapse which corresponded exactly with the first attack, with this difference, that a different set of glands and lymphatics were affected. After this relapse there was again apparent recovery, and then a second relapse. In some cases there were as many as six relapses, the relapses occurring regularly every second day. In nearly all the cases recovery was slow, and in some abcesses formed near the angle of the jaw. In three cases the disease proved fatal. When inquiry was instituted it was found that over 300 individuals had suffered from this disease, and that all had been using milk from the same dairy. The milk when examined was found to contain numerous micrococci, fungi spores, and spores which resembled those of bacillus anthracis—the familiar organism which caused splenic fever. When cultivated the spores germinated into exceedingly delicate bacilli, which on further cultivation lengthened into spore-bearing filaments. On inoculating rats with the milk containing the spores, convulsions and death followed in from 18 to 24 hours. The tissues of these rats, especially in the region of the neck, were infiltrated with bacilli, which on cultivation developed into spore bearing filaments, which retained all the virulence, as was proved by inoculation, of the original spores found in the milk. As confirmatory evidence of the relation of the bacillius to the disease, a small quantity of pus was removed from an abscess of one of the sufferers, and subjected to microscopic examination. In this pus (taken from an abscess over an angle of the jaw) spores and bacilli were found similar to those found in, or developed from, the milk. When a rat was inoculated with a minimal quantity of this pus, it suffered and died in the same way as the rats which were inoculated with the milk. Further investigations proved that the organisms had been added to the milk along with the water. All the water in use passed through a large cistern (provided with a rough loose wooden cover) placed in a corner of the byre immediately over the head of several cows. From the water it was traced to the hay tank—the cistern in which the hay was steamed before it was used as food. But how it reached the hay tank has not been discovered. Experiments with the bacillus showed—(1) that it could not be converted into the common hay bacillus (B. subtilis), and that the hay bacillus could not be got to assume virulent properties; (2) that the cultivations generally became less active until the bacillus became quite innocuous; (3) that when the filaments were kept at a temperature which prevented the formation of the spores, the virulence, as Pasteur showed was the case with the bacillus anthracis, became attenuated and ultimately disappeared. Further experiment, he hoped, would show whether this bacillus was capable of affording protection from the active condition.

Professor **Burdon Sanderson** held that although it was possible to cultivate minute organisms in a mitigated or virulent form at will, their connexion with disease was not yet satisfactorily defined. At most it was expressed by the French word *solidarite*. They could not say that the organism was the cause of the disease, any more than they could say that the disease was the cause of the organism. All they knew was that they had before their eyes two natural processes which seemed to be inseparably associated. They had still to learn the exact relations of these to each other. Only one or two diseases existed in which any relation was seen to exist between the development of the organism and the disease itself—namely, the anthracoid diseases and relapsing fever.

GEOGRAPHY.

The Geographical Section reassembled under the presidency of Sir Joseph Hooker. The proceedings opened with a paper by Sir R. Temple, on "The Progress of Geography in Asia during the last Fifty Years."

The author described the physical geography of the country, pointed out those portions which had been explored and partly explored, and after a reference to some of the discoveries made in recent years, said geographers from most of the European nations had laboured for a common end; the efforts of the Governments, of societies, and of individuals, had been combined, and the results had been on the whole commensurate with the cost in money and resources, and with the wear and tear in human life and strength. The great share borne by England and Russia was only proportionate to the magnitude of their stake in Asia. Other European nations had also earned a title to geographical fame. Still, it must be admitted that the greater part of Asia had not yet been touched by scientific operations on a complete scale. In the whole of Asia only India, Ceylon, Cyprus, Western Palestine, Caucasia, the Caspian basin, part of Western Siberia, and part of Japan; also many points in the Asiatic coast line had been subjected to trigonometrical observation, and even in the professionally surveyed territories many defects and imperfections were acknowledged to remain. The southern coasts of Asia had been surveyed in sufficient detail for geographical purposes. Yet, according to the demands of a growing traffic and of maritime resort these surveys need frequently to be amplified in detail. The ordinary surveys by the Indian Navy were good in their day, and reflected honour on Moresby, Ross, and others; still the Government had ordered a new survey to be made for nautical purposes. A fresh survey might have to be made one day for the whole of the Red Sea and the Persian Gulf. The British Admiralty were making yearly additions to the surveys of the Chinese coasts. There were at present unexplored parts of the Himalayas, of Afghanistan, and Beloochistan; of Arabia nearly the whole of the Kuen Lun region, north of Thibet, in the very heart of Asia. Further, among the principal geographical problems awaiting solution were the connexion of the Thibetan San Po with the Indian Brahmapootra, the existence of mountains connecting the Kuen Lun range eastwards with the Chinese ranges, the sources and upper courses of the Irrawaddy, Salwen, Meking, and Hoang Ho, the disposition of the mountains between the Ladakh passes and the Hindoo Kush, or Indian Caucasus, north of Cabul, near to the culminating region of the entire continent.

MECHANICAL SCIENCE.

On September 1st Sir W. Armstrong, the President of the section of Mechanical Science, delivered his address. After some observations on the astonishing progress which has been made in the construction and application of machinery during the past half-century, and on the notions of heat entertained by men of science in past times, he said:—

The mechanical theory of heat is now universally accepted, although a remnant of the old doctrine is displayed in the continued use of the misleading term "latent heat." According to the new theory heat is an internal motion of molecules capable of being communicated from the molecules of one body to those of another, the result of the imparted motion being either an increase of temperature or the performance of work. The work may be either external, as where heat, in expanding a gas, pushes away a resisting body; or it may be internal, as where heat pulls asunder the cohering particles of ice in the process of liquefaction; or it may be partly internal and partly external, as it is in the steam-engine, where the first effect of the heat is to separate the particles of water into vapour, and the second to give motion to the piston. Internal as well as external work may be reconverted into heat, but until the reconversion takes place the heat which did the work does not exist as heat, and it is delusive to call it "latent heat." All heat problems are comprised under the three leading ideas of internal work, external work, and temperature, and no phraseology should be used that conflicts with those ideas. The modern theory of heat has thrown new light upon the theory of the steam-engine. We now know what is the mechanical value in foot-pounds of the heat evolved in the combustion of 1lb. of coal. In practice we can determine how much of the heat is transmitted to the water in the boiler, and we are taught how to calculate the quantity which in the process of vaporization takes the form of internal work. We can desermine how much disappears in the engine in the shape of external work, including friction, and the remainder, with the exception of the trifling quantity saved in the feed water, we know to be lost. Taking a good condensing engine as an example, we may roughly say that, dividing the whole heat energy into ten equal parts, two escape by the chimney, one is lost by radiation and friction, six remain unused when the steam is discharged, and one only is realized in useful work. It may be fully admitted that the greater part of the aggregate loss is inevitable; but are we to suppose that the resources of science, ingenuity, and skill have been exhausted in the attainment of so miserable a result? Nothing but radical changes can be expected to produce any great mitigation of the present monstrous waste. Sir W. Armstrong then proceeded to point out the directions in which amelioration is theoretically possible, and afterwards adverted to the question whether we may hope to evade the difficulties of the steam-engine by resorting to electrical methods of obtaining power. With regard to this important question, most people, he said, especially those who are least competent to judge, look to electricity as the coming panacea for all mechanical deficiency, and certainly the astonishing progress of electricity as applied to telegraphy, and to those marvellous instruments of recent invention which the British Post Office claims to include in its monopoly of the electric telegraph, as well as the wonderful advance which electricity has made as an illuminating agent, does tend to impress us with faith in its future greatness in the realm of motive power as well. The difference between heat and electricity in their modes of mechanical action is very wide. Heat acts by expansion of volume, which we know to be a necessarily wasteful principle, while electricity operates by attraction and repulsion, and thus produces motion in a manner which is subject to no greater loss of effect than attends the motive action of gravity, as exemplified in the ponderable application of falling water in hydraulic machines. If, then, we could produce electricity with the same facility and economy as heat, the gain would be enormous; but this, as yet at least, we cannot do. At present by far the cheapest method of generating electricity is by the dynamic process. Instead of beginning with electricity to produce power, we begin with power to produce electrity. As a secondary motor, an electric engine may, and assuredly will, play an important part in future applications of power; but our present inquiry relates to a primary and not a secondary employment of electricity. Thus we are brought to the question, from what source, other than mechanical action, can we hope to obtain a supply of electricity sufficiently cheap and abundant to enable it to take the place of heat as a motive energy. It is commonly said that we know so little of the nature of electricity that it is impossible to set bounds to the means of obtaining it; but ignorance is at least as liable to mislead in the direction of exaggerated expectation as in that of incredulity. It may be freely admitted that the nature of electricity is much less understood than that of heat, but we know that the two are very nearly allied. The doctrine that heat consists of internal motion of molecules may be accepted with almost absolute certainty of its truth. The old idea of heat being a seperate entity is no longer held, except by those who prefer the fallacious evidence of their senses to the demonstrations of science. So, also, the idea of electricity having a separate existence from tangible matter must be discarded; and we are justified in concluding that it is merely a strained or tensional condition of the molecules of matter. Although electricity is more prone to pass into heat than heat into electricity, yet we know that they are mutually convertible. In short, I need scarcely remind you that, according to that magnificent generalization of modern times, so pregnant with great consequences, and for which we are indebted to many illustrious investigators, we now know that heat, electricity, and mechanical action are all equivalent and transportable forms of energy, of which motion is the essence. To take a cursory view of our available sources of energy, we have, firstly, the direct heating power of the sun's rays, which as yet we have not succeeded in applying to motive purposes. Secondly, we have water power, wind power, and tidal power, all depending upon influences lying outside of our planet. And, thirdly, we have chemical attraction or affinity. Beyond these there is nothing worth naming. Of the radiant heat of the sun I shall have to speak hereafter; and bearing in mind that we are in search of electricity as a cause and not an effect of motive power, we may pass over the dynamical agencies comprised under the second head, and direct our attention to chemical affinity as the sole remaining source of energy available for our purpose. At present we derive motive power from chemical attraction through the medium of heat only, and the question is, can we with advantage draw upon the same source through the medium of electricity? The process by which we obtain our supply of heat from the exercise of affinity is that of combustion, in which the substances used consist, on the one hand, of those we call fuel, of which coal is the most important, and on the other, of oxygen, which we derive from the atmosphere. The oxygen has an immense advantage over every other available substance in being omnipresent and costless. The only money value involved is that of the fuel, and in using coal we employ the cheapest oxidizable substance to be found in nature. Moreover the weight of coal used in the combination is only about one-third the weight of oxygen, so that we only pay upon one-fourth of the whole material consumed. Thus we have combinations of the most favourable description for the production of energy, in the form of heat, and if we could only use affinities of the same substances with equal facility to evolve electric energy instead of heat energy there would be nothing more to desire; but as yet there is no appearance of our being able to do this. According to our present practice we consume zinc, instead of coal, in the voltaic production of electricity, and not only is zinc 30 or 40 times dearer than coal, but it requires to be used in sixfold larger quantity in order to develop an equal amount of energy. Some people are bold enough to say that, with our present imperfect knowledge of electricity, we have no right to condemn all plentiful substances other than coal as impracticable substitutes for metallic zinc; but it is manifest that we cannot get energy from affinity where affinity has already been satisfied. The numerous bodies which constitute the mass of our globe, and which we call earths, are bodies in this inert condition. They have already, by the union of the two elements composing them, evolved the energy due to combination, and that energy has ages ago been dissipated in space in the form of heat, never again to be available to us. As well might we try to make fire with ashes as to use such bodies over again as sources of either heat or electricity. To make them fit for our purpose we should first have to annul their state of combination, and this would require the expenditure of more energy upon them than we could derive from their recombination. Water, being oxidized hydrogen, must be placed in the same category as the earths. In short, the only abundant substances in nature possessing strong unsatisfied affinities are those of organic origin, and in the absence of coal, which is the accumulated product of a past vegetation, our supply of such substances would be insignificant. This being the case, until a means be found of making the combination of coal with oxygen directly available for the development of electric energy, as it now is of heat energy, there seems to be no probability of our obtaining electricity from chemical action at such a cost as to supplant heat as a motive agent. Sir W. Armstrong then discussed the transmutation of heat economically into the more available form of electricity, and continued—It is only the want of an efficient apparatus for converting heat into electricity that prevents our using the direct heating action of the sun's rays for motive power. In our climate, it is true, we shall never be able to depend upon sunshine for power, nor need we repine on that account so long as we have the preserved sunbeams which we possess in the condensed and portable form of coal, but in regions more favoured with sun and less provided with coal the case would be different. The actual power of the sun's rays is enormous, being computed to be equal to melting a crust of ice 103 feet thick over the whole earth in a year. Within the tropics it would be a great deal more, but a large deduction would everywhere have to be made for absorption of heat by the atmosphere. Taking all things into account, however, we shall not be far from the truth in assuming the solar heat in that part of the world to be capable of melting annually, at the surface of the ground, a layer of ice 85 feet thick. Now let us see what this means in mechanical effect. To melt 1lb. of ice requires 142·4 English units of heat, which multiplied by 772 gives us 109,932 foot-pounds as the mechanical equivalent of the heat consumed in melting a pound of ice. Hence we find that the solar heat operating upon an area of one acre in the tropics, and competent to melt a layer of ice 85 feet thick in a year, would, if fully utilised, exert the amazing power of 4,000 horses acting for nearly nine hours every day. In dealing with the sun's energy we could afford to be wasteful. Waste of coal means waste of money, and premature exhaustion of coal beds. But the sun's heat is poured upon the earth in endless profusion—endless, at all events, in a practical sense, for whatever anxiety we may feel as to the duration of coal, we need have none as to the duration of the sun. We have therefore only to consider whether we can divert to our use so much of the sun's motive energy as will repay the cost of the necessary apparatus, and whenever such an apparatus is forthcoming we may expect to bring into subjection a very considerable porportion of the 4,000 invisible horses which science tells us are to be found within every acre of tropical ground. But whatever may be the future of electricity as a prime mover, either in a dominant or subordinate relation to heat, it is certain to be largely used for mechanical purposes in a secondary capacity, that is to say, as the offspring instead of the parent or motive power. The most distinctive characteristic of electricity is that which we express by the word "current," and this gives it great value in cases where power is required in a transmissible form. The term may be objected to as implying a motion of translation analogous to the flow of liquid through a pipe, whereas the passage of electricity through a conductor must be regarded as a wave-like action communicated from particle to particle. In the case of a fluid current through a pipe, the resistance of the flow increases as the square of the velocity, while in the case of an electric current the resistance through a given conductor is a constant proportion of the energy transmitted. So far, therefore, as resistance is concerned electricity has a great advantage over water for the transmission of power. The cost of the conductor will, however, be a grave consideration where the length is great, because its section must be increased in proportion to the length to keep the resistance the same. It must also be large enough in section to prevent heating, which not only represents loss, but impairs conductivity. To work advantageously on this system a high electromotive force must be used, and this will involve loss by imperfect insulation, increasing in amount with the length of the line. For these reasons there will be a limit to the distance to which electricity may be profitably conveyed, but within that limit there will be wide scope for its employment transmissively. Whenever the time arrives for utilizing the power of great waterfalls the transmission of power by electricity will become a system of vast importance. Even now, small streams of water inconveniently situated for direct application, may, by the adoption of this principle, be brought into useful operation. For locomotive purposes, also, we find the dynamo-electric principle to be available, as instanced in the very interesting example presented in Siemens' electric railway, which has already attained that degree of success which generally foreshadows an important future. It forms a combined fixed engine and locomotive system of traction, the fixed engine being the generator of the power and the electric engine representing the locomotive. Steam power may both be transmitted and distributed by the intervention of electricity; but it will labour under great disadvantage when thus applied, until a thoroughly reflective electric accumulator be provided, capable of giving out electric energy with almost unlimited rapidity. How far the secondary battery of M. Faure will fulfil the necessary conditions remains to be seen; and it is to be hoped that the discussions which may be expected to take place at this meeting of the British Association will enable a just estimate of its capabilities to be formed. The introduction of the Faure battery is at any rate a very important step in electrical progress. It will enable motors of small power, whatever their nature may be, to accomplish by uninterrupted action the effect of much larger machines acting for short periods, and by this means the value of very small streams of water will be greatly enhanced. This will be especially the case where the power of the stream is required for electric lighting, which, in summer, when the springs are low, will only be required during the brief hours of darkness, while in winter the longer nights will be met by a more abundant supply of water. Even the fitful power of wind, now so little used, will probably acquire new life when aided by a system which will not only collect, but equalise the variable and uncertain power exerted by the air. It would greatly add to the utility of the Faure battery if its weight and size could be considerably reduced, for in that case it might be applicable to many purposes of locomotion. We may easily conceive its becoming available in a lighter form for all sorts of carriages on common roads, thereby saving to a vast extent the labour of horses. Even the nobler animal that strides a bicycle, or the one of fainter courage that prefers the safer seat of a tricycle, may ere long be spared the labour of propulsion; and the time may not be distant when an electric horse far more amenable to discipline than the living one may be added to the bounteous gifts which science has bestowed on civilized man.

Sir W. Armstrong occupied the chair again on Friday (September 2). Sir F. J. Bramwell read a paper on some of the developments of mechanical engineering during the last half-century, which appears in another column.

Attempt at an Explanation of the Tails of Comets.—A. Picart.—Until lately there have been admitted only three states of matter, the solid, the liquid, and the gaseous. Recently there has been added a fourth state, the radiant—that of a gas so rarefied that each of its molecules, in its movement, according to the dynamic hypothesis of Bernouilli, experiences merely few shocks from other molecules, and describes a trajectory composed of rectilineal elements. These are the states of so-called ponderable matter, obeying the law of gravitation. But there is another matter, imponderable, diffused uniformly in the universe, forming a sort of substratum, in which ponderable matter moves, and which is perhaps the only matter, becoming transformed by the movement, and the varied grouping of its atoms of different forms into the different states of ponderable matter. When this matter is agitated in any point, this point becomes a focus of light, so that if it is in vibration for a certain extent it presents the appearance of a luminous body. It is then, as it were, a new state of matter, which may be called the luminous state, consisting in the vibratory condition of an accumulation, more or less extensive, of the ethereal matter. But the peculiarity of the ether, as of all fluid matter, is that the intermittent repulsion of its atoms produced by the shocks which they impart in their mutual movements, may be ideally expressed as a permanent repulsion between these atoms supposed to be immovable—a repulsion which varies according to a certain function of the distance, decreasing as the latter increases. This new imponderable matter possesses the characteristic property that a repulsive action is exerted between its elements. The author explains certain cosmic phenomena by means of this form of matter.

16 JA 82
MUSEUM